*** NORMALIZING AND CONTACT RATE FACTORS ***

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
BODY WEIGHT													
Bortolotti 1984a	J	M	-	-	4,066	35.08	SE g	3,575	4,500	26	Saskatchewan	lake	Age = 60 days; growth not complete
	J	F	-	-	5,172	46.54	SE g	4,800	5,600	21	CAN, 1980-82		at this age or at age of fledging.
Brown & Amadon	A	M	-	-			g	4,000	4,600		Alaska &	NS	
1968	A	F	-	-	6,300		g				Canada		
(alascensis)													
Chura & Stewart	A	M	-	WI	4,833		g	4,238	5,642	7	Alaska 1962	lab	Birds caught in November and
1967	J	F	-	WI	5,642		g			1			December for DDT tests. Juveniles =
	J	M	-	WI	4,904		g			1			immature eagles. Two juveniles were
	J	-	-	WI	4,677		g	4,706	4,649	2			of unkown sex.
Imler & Kalmbach	J	M	-	SU	4,014		g	3,524	4,568		Alaska	NS	Immature eagles (up to three years
1955	J	F	-	SU	5,089		g	4,359	5,756				old). N = 18 for both sexes combined. As cited in Maestrelli and Wiemeyer 1975; Bartolotti 1984a.
Snyder & Wiley	A	F	-	-	5,244		g			37	NS	NS	As cited in Dunning 1984.
1976	A	M	-	-	4,123		g			35			
Wiemeyer 1991	A	F	-	-	4,500		g				Florida	NS	Approximate.
pers. comm.	A	M	-	-	3,000		g						
EGG WEIGHT													
Bortolotti 1984b	-	-	-	-	114.4	10.59	SD g			17	Saskatchewan CAN, 1980-82	lake	
Krantz et al. 1970	-	-	-	-	120.6	8.2	SD g	108	134	14	Wisconsin 1968	NS	Weight estimate calculated from egg volumes (in ml) presented by author using 1.0 as the assumed specific gravity (after Stickel et al. 1966).
Krantz et al. 1970	-	-	-	-	102.5	17.9	SD g	71	125	6	Florida 1968	NS	Weight estimate calculated from egg volumes (in ml) presented by author using 1.0 as the assumed specific gravity (after Stickel et al. 1966).

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
HATCHING WEIGHT													
Bortolotti 1984b	-	B	-	-	91.5	5.17 SD	g			6	Saskatchewan CAN, 1980-82	lake	Nestlings weighed soon after hatching.
NESTLING WEIGHT													
Bortolotti 1984b	N	B	-	-	500		g 10 days			47	Saskatchewan	lake	Number of days in units column is the age of nestlings. Values estimated from Figure 4.
	N	B	-	-	1,300		g 20 days			47	CAN, 1980-82		
	N	M	-	-	2,700		g 30 days			26			
	N	F	-	-	3,000		g 30 days			21			
	N	M	-	-	3,100		g 40 days			26			
	N	F	-	-	3,900		g 40 days			21			
	N	M	-	-	3,600		g 50 days			26			
	N	F	-	-	4,600		g 50 days			21			
FLEDGING WEIGHT													
Maestrelli &	-	-	-	-	3,639		g			1	Maryland	captive	Sample size too small.
Wiemeyer 1975	-	-	-	-	4,671		g			1			
NESTLING GROWTH RATE													
Bortolotti 1989	N	B	1	SU	0.067	0.0009 SE	K			20	Saskatchewan	lake	Value is the mean growth curve parameter (K) for individual Grompertz growth equations. Nestlings from (1) East end of lake; (2) west end. West end was thought to have better food supplies.
	N	B	2	SU	0.070	0.0007 SE	K			20	CAN, 1980-82		
METABOLIC RATE (KCAL BASIS)													
Craig et al. 1988	A	B	-	WI	448	17 SD	kcal/d				Connecticut	river	Estimated daily energy budget.
	J	B	-	WI	499	17 SD	kcal/d				1986		
Gessaman et al. 1991	B	-	1	-	41.1	3.1 SD	kcal/kg-d			2	Utah 1987	lab	Resting (perching) metabolism determined by oxygen consumption. Values are means for trials conducted on one adult (3.7 kg) and one immature (3.9 kg) eagle. Conditions: (1) day (08:00 - 20:00), 0 degrees C; (2) night (20:00 - 08:00), 0 degrees C; (3) day, 15 C; (4) night, 15 C.
	B	-	2	-	37.4	4.5 SD	kcal/kg-d			2			
	B	-	3	-	42.1	2.1 SD	kcal/kg-d			2			
	B	-	4	-	40.2	2.7 SD	kcal/kg-d			2			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Keister et al. 1985	B	B	R	WI			kcal/night	<120	209		sc Oregon, n California 1979-80	lake, forest	Energy demand per night roosting; these varied with roost site and ambient temperature.
Stalmaster & Gessaman 1982	A	B	1	-	96.4	25 SD	kcal/kg-d	57	140		NS 1980	lab	Resting winter-acclimatized eagles. Existence metabolism at temperature = (1) -10 C; (2) 5 C; (3) 20 C, calculated from equations developed from empirical data at the three temperatures. EM (kcal/kg-day) = 88.05 - 0.84 T ambient. SDs and ranges estimated from Figure 2.
	A	B	2	-	83.9	28 SD	kcal/kg-d	40	138				
	A	B	3	-	71.3	18 SD	kcal/kg-d	45	100				
Stalmaster & Gessaman 1984	B	B	BA	WI	66.6		kcal/kg-d			4	NS 1978-80	lab	Calculated by measuring oxygen consumption.
Stalmaster & Gessaman 1984	B	B	-	WI	90		kcal/kg-d			4	Washington 1978-80	river	Flying metabolism; 4.5 kg eagle assumed.
FOOD INGESTION RATE													
Chura & Stewart 1967	A	M	-	WI	0.0741	0.0033 SE	g/g-day	0	0.1652	112	Alaska 1962-63	captive	N = days of captivity. Food consumption by control birds in DDT test. Food was ground fish (frozen and then thawed for use). Weight of birds used was weight at capture; adult gained 0.3% body weight over test period, immature lost 14%.
	J	-	-	WI	0.0612	0.0034 SE	g/g-day	0	0.1487	112			
Craig et al. 1988	A	B	FY	WI	533	17 SD	g/bird-d				Connecticut 1986	river	Estimate of food consumed based on observed feeding behaviors and Stalmaster & Gessaman (1984) model.
	J	B	FY	WI	608	21 SD	g/bird-d						
Craig et al. 1988	A	B	FY	WI	519		g/bird-d				Connecticut 1986	river	Estimated using equation from Stalmaster & Gessaman 1984 that provides prey consumption based on time spent feeding. Authors noted inefficient juvenile feeding, and felt that the equation poorly predicts food ingestion rates for juvenile eagles.
	J	B	FY	WI	1569		g/bird-d						
Craig et al. 1988	A	B	-	WI	538	18 SD	kcal/day				Connecticut 1986	river	Daily gross energy consumption.
	J	B	-	WI	584	18 SD	kcal/day						
Duke et al. 1976	A	-	-	-	0.056		g/g-day				Utah	captive outside	Body weight of eagle was 3,870 g; it was fed mice at an ambient temperature of 27 degrees C. As cited in Duke et al. 1987.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Stalmaster 1980	A	-	1	-	500		g/day				Washington 1974-80	river	Foods: (1) spawned-out salmon; (2) all other foods. Author notes that gorging of up to 900 g of food may permit eagles to eat every other day.
	-	-	2	-	300-400		g/day						
Stalmaster & Gessaman 1982	B	B	1	-	0.092	0.0255 SD	g/g-day			4	Utah 1980	lab	Winter-acclimatized eagles. Mean of 4 eagles tested at three temperatures (-10, 5, & 20 degrees C) and fed three types of food: (1) salmon; (2) black-tailed jackrabbit; (3) mallard duck. Authors provide model to predict food consumption with temperature for these three different diets.
	B	B	2	-	0.0748	0.0130 SD	g/g-day			4			
	B	B	3	-	0.0651	0.0115 SD	g/g-day			4			
Stalmaster & Gessaman 1984	B	B	1	WI	0.1087		g/g-day				Washington 1978-80	river	Estimated from observed captures of pre-weighed fish provided at a feeding station; in each case the food was salmon and the eagles were free living. (1) Calculated minimum food requirement; (2) mass food consumed with assuming eagle mass of 4.5 kg.
	A	B	2	WI	0.1227		g/g-day						
	J	B	2	WI	0.0911		g/g-day						
	Y	B	2	WI	0.1020		g/g-day						
Stalmaster & Gessaman 1982	B	B	1	-	118.4	26 SD	kcal/kg-d	74	170		NS 1980	lab	Existence metabolism conditions; winter-acclimatized eagles. Gross energy intake (GEI) at temperature = (1) -10 C; (2) 5 C; (3) 20 C. Estimated by author from equations developed from empirical data: GEI (kcal/kg-d) = 109.4 - 0.90 ambient temperature. Values were normalized to a 4.5 kg bird. Range and SD estimated from Figure 2.
	A	B	2	-	104.9	28 SD	kcal/kg-d	51	160				
	J	B	3	-	91.4	15 SD	kcal/kg-d	53	117				
Stalmaster & Gessaman 1984	B	B	-	WI	110		kcal/kg-d			4	Washington 1978-80	river	Flying metabolism; 4.5 kg eagle assumed. Total energy intake required.
Stalmaster & Gessaman 1982	B	B	1	-	0.0884	0.0239 SD	g/g-day			4	Utah 1980	lab	Winter-acclimated eagles; 4 birds each fed 3 different diets at temperatures of (degrees C): (1) -10; (2) 5; (3) 20. Three diets were salmon, jackrabbit, and mallard.
	B	B	2	-	0.0755	0.0186 SD	g/g-day			4			
	B	B	3	-	0.0680	0.0144 SD	g/g-day			4			

***** DIET *****

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Dugoni et al. 1986	B	B	muskrat		7.4			9	Louisiana	swamp	Remains collected from 9 nests following fledging of young.
			nutria		5.8					-	
			other mammal		2.4					% frequency of occurrence; prey remains at nest	
			American coot		20.2						
			mottled duck		4.5						
			blue winged teal		4.1						
			other birds		13.6						
			catfish		21.8						
			other fish		19.8						
			reptiles		0.4						
Dunstan & Harper 1975	B	B	bullhead catfish		35.1			6	Minnesota 1967-72	lake	Prey remains collected in and below 6 active nests.
			suckers		29.1					-	
			northern pike		13.9					% frequency of occurrence; prey remains at nests	
			largemouth bass		5.0						
			rock bass		4.0						
			other fish		3.0						
			ducks		4.6						
			other birds		3.3						
			other		1.9						
Fielder & Starky 1980	B	B	american coot				14.7	61	Washington 1977-79	reservoir	Lake Pateros (reservoir); N = number of prey items found.
			mallard				6.6			-	
			scaup				3.3			% frequency of occurrence; prey remains at and below nest	
			redhead				3.3				
			other waterfowl				8.2				
			chukar				45.9				
			other birds				8.2				
			brown bullhead				3.3				
			walleye				3.3				
			unidentified fish				3.2				
Fielder & Starky 1980	B	B	american coot				75	340	Washington 1977-79	reservoir	Rufus Woods Lake (reservoir); N = number of prey items found.
			american widgeon				4.7			-	
			mallard				4.1			% frequency of occurrence; prey remains at and below nest	
			other waterfowl				7.4				
			other birds				1.2				
			brown bullhead				4.1				
			carp				1.2				
			sucker				1.8				
			other fish				0.5				

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Fielder 1982	B	B	mallard				8	485	Washington	reservoir	Lake Pateros (reservoir); N = number of prey items found.
			American widgeon				4.3		1977-82	-	
			American coot				64.1			% frequency of occurrence; items found below perches	
			other waterfowl				9.2				
			non-waterfowl birds				4.7				
			brown bullhead				3.1				
			other fish				6.2				
Fielder 1982	B	B	mallard				11.8	85	Washington	reservoir	Rufus Woods Lake (reservoir); N = number of prey items found.
			American coot				11.8		1978-82	-	
			other waterfowl				12.9			% frequency of occurrence; prey remains below perches	
			chukar				45.9				
			other non-waterfowl				9.4				
			sucker				3.5				
			walleye				2.4				
			unidentified fish				2.4				
Fitzner & Hanson 1979	B	B	mallard				32	72	Washington	river	N = number of prey items.
			American widgeon				9		1975-76	-	
			American coot				9			% biomass; prey remains below communal roosts	
			other birds				3				
			Chinook salmon				21				
			sucker				4				
			European carp				1				
			other fish				1				
			unaccounted				20				
Frenzel & Anthony 1989	B	B	snow goose				7.6	913	n CA, s OR	lake	N = number of prey items. Eagles were frequently observed feeding on montane voles which they probably ate whole (no remains).
			mallard				25.3		1979-82	-	
			northern pintail				14.8			% frequency of occurrence; prey remains from below hunting perches	
			american widgeon				23.3				
			ruddy duck				9.4				
			american coot				4.1				
			other birds				14.9				
			mammals				0.5				
			reptiles				0.1				
Grubb & Hensel 1978	B	B	fish		25			36	Alaska	coastal	Season not specified, but probably is spring/summer because eagles are nesting.
			(humpback salmon)		(15)				1963,67,68	-	
			birds		62					% frequency of occurrence; prey remains at nest	
			(ducks)		(7.5)						
			(seabirds)		(15)						
			(glauc. winged gull		(22.5)						
			fox		5						
			invertebrates		7.5						

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Grubb & Hensel 1978	B	B	fish		85			36	Alaska 1963,67,68	inland - % frequency of occurrence; prey remains at nest	Season not specified, but is probably spring/summer because eagles are nesting.
			(char)		(44.6)						
			(sockeye salmon)		(36.5)						
			birds		10						
			(common goldeneye)		(5.4)						
			(other ducks)		(2.7)						
			(gulls)		(1.4)						
			mammals		5						
			(snowshoe hare)		(1.4)						
			(tundra vole)		(2.7)						
			(reindeer)		(1.4)						
Haywood & Ohmhart 1983	B	B	channel catfish		27.9			7	Arizona 1979-80	desert scrub, riparian - % frequency of occurrence; prey items at and below nests	N = number of nests. Seasons are spring and summer.
			carp		16.1						
			Sonora sucker		11.8						
			other fish		7.3						
			American coot		5.9						
			other birds		10.3						
			cottontail rabbit		4.4						
			jack rabbit		4.4						
			other mammals		11.8						
Haywood & Ohmart 1986	B	B	fish		57.6			481	c Arizona 1979-82	desert scrub, riparian - % biomass; prey brought to or found at nests	Breeding season; 11 nests observed over a five year period. N = number of prey identified. Individual prey types comprising less than 1% of the total not listed here.
			(channel catfish)		(21.8)						
			(Sonora sucker)		(8.6)						
			(carp)		(17.3)						
			(flathead catfish)		(2.4)						
			(desert sucker)		(3.3)						
			(bass species)		(2.8)						
			birds		14.1						
			(American coot)		(8.1)						
			(great blue heron)		(4.4)						
			mammals		28.1						
			(desert cottontail)		(8.1)						
			(jackrabbit)		(14.9)						
			(rock squirrel)		(1.1)						
			reptiles		0.2						
Kozie & Anderson 1991	B	B	suckers		27.6			156	Wisconsin 1983-88	islands & shoreline of Lake Superior - % frequency of occurrence; prey remains at nest	Found at 53 nests. To consolidate information, suckers were grouped together, and items with less than 2% occurrence were grouped as "other". Islands were the Apostle Islands National Lakeshore.
			burbot		13.5						
			round whitefish		3.8						
			other fish		5.1						
			(fish subtotal)		(50.0)						
			herring gull		21.8						
			blue jay		6.4						
			northern flicker		3.2						
			other birds		14.4						
			unidentified birds		2.6						
			(bird subtotal)		(48.4)						

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Kozie & Anderson (continued) 1991			mammals (whitetailed deer, snowshoe hare)		1.2						
LeFranc & Cline 1983	B	B	fish birds mammals turtles		41 35 14 10			226	MD, VA, DE 1979-81	Chesapeake Bay - % frequency of occurrence; prey remains at nests	Season is early May to early June; N = number of nests. Each nest visited once each year.
McEwan & Hirth 1980	B	B	fish (brown bullhead) (catfish) (lake chubsucker) (black crappie) birds (American coot) (ruddy duck) mammals (rabbits) reptiles	70.3 (46.1) (13.1) (6.1) (2.3) 25.8 (19.0) (2.3) 3.3 (2.4) 0.6				16	nc Florida 1976-76	lakes - % biomass; prey items in nests	Seasons = winter/spring. N = number of nests; items collected after young had fledged. 34 species found; summary includes species comprising 2% or more. Calculations of biomass did not include 4 large mammals probably obtained as carrion and thus only partially consumed by eagles.
Ofelt 1975	A	B	pink salmon herring trout other fish other animals		15.5 32 4.5 24 24			3	Alaska 1971	coastal - % frequency of occurrence; prey brought to nest	Summary of food items visually identified during 30 hours of observation at 3 nests.
Sherrod et al. 1977	-	-	Norway rat (Rathus norvegicus) sea otter (Enhydra lutris) Northern fulmar (Fulmarus glacialis) Short-tailed shear-water (Fulmarus tenuirostris) Cormorant sp. (Phalacrocorax) Rock Ptarmigan (Lagopus mutus) Glaucous-winged gull (Larus glaucescens) Ancient Murrelet (Synthiliboramphus antiquus) Crested Aukulet (Aietha cristatella)		20 56 16 6 5 9 17 13 22			34	Alaska 1972	Amchitka Island - number collected; items in nests	

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Sherrod et al. 1977 (continued)			Least Aukulet (A. pusilla)		9						
			Smooth lumpsucker (Aptocuclus ventricosus)		31						
			Rock greenling (Nexagrammus lagocephalus)		5						
Sherrod et al. 1977	-	-	mammals		36.1			78	Alaska 1971-72	Amchitka Island - average % of diet by biomass	Season not specified. Author notes that carrion comprises a large part of eagles' diet and that eagles regularly scavenge carcases of the harbor seal (Phoca vitulina), the Stellar sea lion (Eumetopias jerbata), sea otters, and whales.
			birds		49.4						
			fish		14.4						
			invertebrates		0.1						
Swenson et al. 1986	B	B	birds		42.7				Idaho, Wyoming 76-82	forested river, lake - % frequency of occurrence; pellets and remains in and under nests	40 species identified; species making up less than 2% of total not listed here.
			(mallard)		(5.4)						
			(coot)		(5.4)						
			(eared grebe)		(2.4)						
			(other aquatic bird		(16.4)						
			fish		43.5						
			(Utah sucker)		(20.4)						
			(cutthroat trout)		(8.2)						
			(Utah chub)		(6.3)						
			(salmonids)		(3.3)						
			mammals		13.9						
			(muskrat)		(3.3)						
Todd et al. 1982	B	B	brown bullhead		24.8			133	Maine 1976-80	inland - % frequency of occurrence; pellets	Season - includes all but winter. Summary of 32 food types presented in paper.
			white sucker		19.5						
			chain pickerel		20.1						
			smallmouth bass		3.8						
			white perch		3.6						
			other fish		4.9						
			black duck		3.0						
			other birds		13.5						
			mammals		6.8						
Todd et al. 1982	B	B	black duck		14.8			269	Maine 1976-80	coastal - % frequency of occurrence; pellets	All seasons. N = number of pellets collected. Summary of 67 food types presented in paper.
			herring gull		11.6						
			cormorant		7.6						
			other gulls		7.3						
			common eider		5.6						
			other birds		28.8						
			herring		5.2						
			other fish		11.9						
			mammals		6.9						

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Vermeer & Morgan 1989	-	-	birds		41.2			80	Br. Columbia, CAN 1988	islands - % frequency of occurrence; prey found beneath nesting trees	N = number of items found. Summary includes species found three or more times.
			(glauc. winged gull		(16.3)						
			marine invertebrates		45.0						
			(abalone)		(6.3)						
			(littleneck clam)		(18.8)						
			(California mussel)		(8.8)						
			(red crab)		(5.0)						
			fish		10						
			mammals		3.8						
Watson et al. 1991	B	B	fish		71.0			185	OR, WA 1984-86	Columbia River estuary - % frequency of occurrence; prey remains at nest	Season is year round; N = number of prey found. Fish and bird species comprising less than 2% not reported here.
			(largescale sucker)		(17.3)						
			(American shad)		(13.0)						
			(common carp)		(10.8)						
			(peamouth)		(9.7)						
			(other cyprinids)		(4.3)						
			(salmon)		(8.6)						
			birds		26.1						
			(mallard)		(4.9)						
			(green-winged teal)		(2.2)						
			(western grebe)		(4.3)						
			(cormorant)		(2.7)						
			(gull)		(2.7)						
			mammals		2.0						
			(brush rabbit)		(1.0)						

***** POPULATION DYNAMICS *****

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
HOME RANGE SIZE													
Craig et al. 1988	J	-	1	WI	4		km/day	1	6	4	Connecticut 1986	river	Daily foraging radius from roosts.
	B	B	2	WI	3-7		km/day						
Griffin & Baskett 1985	J	B	1	WI	1,830	1,460 SD	ha			6	Missouri	lake	Minimum home range; J = immature eagles (1-4 years of age). Year: (1) 1978; (2) 1976.
	A	B	1	WI	1,880	900 SD				4			
	J	B	2	WI	4,820	1,830 SD				4			
	B	B	1	WI	1,850	1,200 SD				10			
Grubb 1980	A	B	-	-	3.5		km	1.4	7.2	49	w Washington 1975	San Juan Islands	Occupied breeding territory length determined by aerial surveys of coastline.
Grubb 1980	A	B	-	-	5.5		km	1.1	14.5	28	w Washington 1975	Olympic Penninsula	Occupied breeding territory length determined by aerial surveys of coastline.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Grubb 1980	A	B	-	-	7.2		km	1.4	24.5	24	w Washington 1975	Puget Sound	Occupied breeding territory length determined by aerial surveys of coastline.
Grubb 1980	A	B	-	-	4.8		km	4.2	21.2	4	w Washington 1975	Hood Canal	Occupied breeding territory length determined by aerial surveys of coastline.
Grubb 1980	A	B	-	-	15.8		km	11.1	26.6	6	w Washington 1975	Grays Harbor	Occupied breeding territory length determined by aerial surveys of coastline.
Grubb 1980	A	B	-	-	6.4		km	12.6	13.0	3	w Washington 1975	inland lake, river	Occupied breeding territory length determined by aerial surveys of coastline.
Haywood & Ohmhart 1983	A	B	-	SP	3,494	2,520 SD	ha	1,821	6,392	3	Arizona 1980-81	desert, riparian river	Minimum home range.
Keister et al. 1985	B	B	-	WI	6-20		km				sc OR, n CA 1979-80	Klamath Basin	Foraging radius; range of distances between communal roosts and the three main foraging areas used by the study population.
Mahaffy & Frenzel 1987	A	B	I	SU	0.56	0.18 SE	km radius			4	Minnesota 1979-80	lake, woods	Radius of territory defended against decoy: (I) incubating; (EB) early brooding; (LB) late brooding. feeding.
	A	B	EB	SU	0.55	0.17 SE	km radius			4			
	A	B	LB	SU	0.72	0.21 SE	km radius			2			
Mahaffy & Frenzel 1987	A	B	1	SU	0.67	0.18 SE	km radius			7	Minnesota 1979-80	lake, woods	During incubation and feeding. Radius of territory defended against decoy: (1) access to decoy across water or shoreline; (2) access to decoy across land.
	A	B	2	SU	0.40	0.03 SE	km radius			3			
Nash et al. 1980	A	B	-	SU			km		6		w Washington 1962-80	San Juan Islands	Foraging radius.
Stalmaster & Gessaman 1984	B	B	-	WI	6.1		km/day				Washington 1978-80	river	Daily foraging radius from roosts for wintering eagles.
POPULATION DENSITY													
Dzus & Gerrard 1989	A	B	-	SU	0.104		N/km shore	0.026	0.179	12	Saskatchewan CAN, 1984-87	lakes	Based on aerial surveys in May-June and July-August.
	J	B	-	SU	0.035		N/km shore	0.005	0.088	12			
	B	B	-	SU	0.139		N/km shore	0.031	0.242	12			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Grier 1977	B B	B B	- -	SU SU	0.000084 0.000057		N/ha br area/ha				Ontario, Manitoba, CAN	NS	Total of 53 100 square km quadrats sampled; br area = breeding area. Breeding area counts considered by author to be more reliable than bird counts.
Hansen 1987	A	B	-	SU	0.38		pair/km			89	se Alaska 1980-83	riverine	Based on aerial surveys of 89 breeding territories located within the Chilkat Valley.
Hodges & King 1979	A	B	-	SU	0.9		N/km shore				se Alaska	coastal	As cited in Hodges et al. 1987.
Swenson et al. 1986	A A A	B B B	1 2 3	SU SU SU	0.0352 0.0255 0.0453		pair/km pair/km pair/km				WY, ID, MT 1972-79	rivers, lakes	Breeding areas per kilometer of shoreline. Aerial surveys of three study areas in the Greater Yellowstone Ecosystem: (1) Yellowstone; (2) Continental; (3) Snake.
Vermeer & Morgan 1989	A A	B B	1 2	SP SP	0.11 0.07		nest/km nest/km				Br. Columbia CAN 1988	Barkley Sound	Conservative estimate of nesting population along the edges of: (1) forested islands in the sound; (2) Vancouver Island. A total of 54 nests were observed.
CLUTCH SIZE													
Brown & Amadon 1968	-	-	-	-	2		eggs	1	3		NS	NS	
Schmid 1966-67	-	-	-	-	2.28		eggs	1	4	50	PA, DE, MD, NJ 1935-42,46	NS	Mean calculated from data presented in table. 19 of the 60 successful nestings observed had 3 young present.
Sherrod et al. 1977	-	-	-	-	1.9		eggs			46	Alaska 1969	Amchitka Island	
CLUTCHES/YEAR													
Sherrod et al. 1987	-	-	-	-	1		/year				NS	NS	Will often lay a second clutch if the first is lost early in incubation period.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
DAYS INCUBATION													
Herrick 1932	-	-	-	-	34-35		days				Ohio	wild	As cited in Maestrelli & Wiemeyer 1975.
Hulce 1886; 1887	-	-	-	-	35-37		days			1	Ohio	captive	As cited in Maestrelli & Wiemeyer 1975.
Maestrelli & Wiemeyer 1975	-	-	-	-	35		days	34	38	3	Maryland	captive	
Nicholson 1952	-	-	-	-	35-36		days				Florida	NS	As cited in Maestrelli & Wiemeyer 1975.
AGE AT FLEDGING													
Bortolotti 1989	-	M	1	-	79.9	1.08 SE	days			9	Saskatchewan	lake	(1) East end of lake; (2) west end. West end thought to support larger fish populations.
	-	F	1	-	83.0	0.94 SE	days			11	CAN, 1980-82		
	-	M	2	-	76.1	1.03 SE	days			14			
	-	F	2	-	81.2	1.58 SE	days			6			
Brown & Amadon 1968	-	-	-	-	70-77		days				NS	NS	
Green 1985	-	B	-	-			days	70	98		NS	NS	Summary of available information.
N FLEDGE/ACTIVE NEST													
Grier 1982	-	-	1	-	1.26		N/terr				Ontario, CAN	lake	Young per nesting territory. (1) 1966; (2) 1974; (3) 1981.
	-	-	2	-	0.46		N/terr						
	-	-	3	-	1.12		N/terr						
Henny & Anthony 1989	-	-	-	-	1.01		N/act terr	0.58	1.22	489	California 1977-86	NS	Mean of 10 years of data; minimum and maximum are yearly means. Number of nests surveyed per year = 29-68.
Henny & Anthony 1989	-	-	-	-	1.01		N/act terr	0.00	2.00	38	Colorado 1977-86	NS	Mean of 10 years of data; minimum and maximum are yearly means. Number of nests surveyed per year = 2-10.
Henny & Anthony 1989	-	-	-	-	1.10		N/act terr	0.91	1.38	132	Idaho 1979-86	NS	Mean of 8 years of data; minimum and maximum are yearly means. Nests surveyed per year = 11-26.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Henny & Anthony 1989	-	-	-	-	1.28		N/act terr	1.07	1.58	305	Montana 1978-86	NS	Mean of 9 years of data; minimum and maximum are yearly means. Nests surveyed per year = 9-55.
Henny & Anthony 1989	-	-	-	-	0.95		N/act terr	0.72	1.18	882	Oregon 1978-86	NS	Mean of 9 years of data; minimum and maximum are yearly means. Nests surveyed per year = 35-142.
Henny & Anthony 1989	-	-	-	-	0.90		N/act terr	.76	1.14	1207	Washington 1980-86	NS	Mean of 7 years of data; minimum and maximum are yearly means. Nests surveyed per year = 99-250.
Henny & Anthony 1989	-	-	-	-	.89		N/act terr	.52	1.22	217	Wyoming 1978-86	NS	Mean of 9 years of data; minimum and maximum are yearly means. Nests surveyed per year = 19-35.
Kozie & Anderson 1991	-	-	-	-	1.30		N/act nest			1,469	Wisconsin 1983-88	nests from inland areas	Data reflects young produced by active nest; does not indicate whether young fledged. Diet analysis suggests that nearby Lake Superior birds (not included in mean presented) may be suffering from effects of contaminants; they fledged 0.8 per active nest.
McAllister et al. 1986	-	-	1	-	0.87		N/br terr			301	Washington 1981-85	coastal	(1) direct count; (2) Mayfield - 40% model.
	-	-	2	-	0.59		N/br terr						
McEwan & Hirth 1979	-	-	-	-	1.14		N/act nest			109	Florida 1973-76	lake	
Sherrod et al. 1977	-	-	-	-	0.86		N/act nest			71	Alaska 1972	Amchitka Island	
Sprunt et al. 1973	-	-	-	-	1.00	0.06 SE	N/act nest	0	3	312	Alaska 1963-70	wildlife refuge, island	Seven years of data. At the time of the study, the authors felt that this population represented "as nearly a normal situation as currently exists for this species." Overall, 63% of nests successful.
N FLEDGE/SUCCESSFUL NEST													
Grier 1982	-	-	1	-	1.6		N/suc nest			184	Ontario, CAN	lake	Young counted at nestling stage. Years: (1) 1966-69; (2) 1970-74; (3) 1975-79; (4) 1980-81.
	-	-	2	-	1.5		N/suc nest			184			
	-	-	3	-	1.7		N/suc nest			324			
	-	-	4	-	1.8		N/suc nest			149			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Grubb et al. 1983	-	-	-	-	1.65	0.26 SD	N/suc nest			22	Arizona 1975-80	desert scrub, river	6 year mean; 3-4 nests per year.
Grubb et al. 1983	-	-	-	-	1.35	0.11 SD	N/suc nest	1.22	1.48	170	Washington 1975-80	San Juan Islands	6 year mean; minimum and maximum are yearly means of 23 and 29 nests, repsectively.
Grubb et al. 1983	-	-	-	-	1.47		N/suc nest			60	Washington 1980	spruce & hemlock, Olympic Penninsula	Study area includes the San Juan Islands, Olympic Peninsula, Puget Sound, and other areas.
Howard & Van Daele 1980	-	-	-	-	1.4		N/suc nest			7	Idaho 1979	NS	
Kozie & Anderson 1991	-	-	-	-	1.69		N/suc nest			1,132	Wisconsin 1983-88	nests from inland areas	Reflects young produced per succesful nest; data does not include whether young fledged.
McAllister et al. 1986	-	-	-	-	1.42		N/suc pair	1.35	1.51	45	Washington 1981-85	coastal	4 year mean; minimum and maximum are yearly means.
McEwan & Hirth 1979	-	-	-	-	1.59		N/suc nest			78	Florida 1973-76	lake	
Nash et al. 1980	-	-	-	-	1.3		N/suc terr	1.0	1.7		Washington 1970-79	coastal island	Ten years of study; minimums and maximums are yearly means of fledglings per successful territory.
Opp 1980	-	-	-	-	1.53		N/suc ter			8	Oregon 1978-79	various	
Schmid 1966-67	-	-	-	-	2.2		N/suc nest	1	3	47	PA, DE, MD, NJ 1936-42,46	NS	Data reflects young seen in nests, not number that fledged.
Sherrod et al. 1977	-	-	-	-	1.42		N/suc nest			71	Alaska 1972	Amchitka Island	
Sprunt et al. 1973	-	-	-	-	1.06	0.06 SE	N/suc nest	1	3	196	Alaska 1963-70	wildlife refuge, island	Mean of 7 years of data. Authors felt that at the time of the study, this population represented "as nearly a normal situation as currently exists for this species."
Swenson et al. 1986	-	-	-	-	1.64		N/suc nest			160	ID, MT, WY 1976-82	forested river, lake	Study of three populations in the Greater Yellowstone ecosystem over six years.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
AGE AT SEXUAL MATURITY													
Nye 1983	-	B	-	-	4			3	5	7	United States	NS	Age of first breeding of seven nesting birds from U.S. hacking projects. The bird breeding at 3 was a male; total of 4 males, 3 females.
ANNUAL MORTALITY													
Grier 1980	A	B	-	-	10-30		%/yr				NS	NS	Hypothetical ranges based on author's experience used for population modelling. Juveniles are first year birds; adults are second year birds and older.
	J	B	-	-	30-70		%/yr						
Sherrod et al. 1977	A	-	1	-	5.4		%/yr				Alaska 1968-74	Amchitka Island	(1) Adults are five year birds. Mortality based on assumption that annual mortality rate is equal to the rate of recruitment of eye-stripe (as suggested by Ricklefs 1973), and that mortality of eye-stripe birds is low; (2) juveniles (subadults) from fledging to one year old.
	J	-	2	-	89.3		%/yr						
LONGEVITY													
Snow 1973	A	B	-	-			yrs		50		NS	captivity	Living 50 years in captivity is not unusual.

***** SEASONAL ACTIVITIES *****

Reference	Begin	Peak	End	Location	Habitat	Notes
MATING/LAYING						
Brown & Amadon 1968	late Mar		earl Apr	Vancouver, BC, CAN	coastal	
Brown & Amadon 1968	earl Nov		late Jan	Florida	NS	
Grubb et al. 1983	Dec		late Jan	c Arizona	desert scrub, river	

Reference	Begin	Peak	End	Location	Habitat	Notes
Grubb 1976	Jan		earl Mar	Colorado	NS	As cited in Green 1985.
Grubb 1976	late Feb		thru Mar	Washington	NS	As cited in Green 1985.
Hansen 1987	earl May			se Alaska	river	
Howard & van Daele 1980	mid Feb			w Idaho 1979	NS	
LeFranc & Cline 1983	Feb			MD, VA, DE	Chesapeake Bay	
Mager 1977	late Sep		thru Nov	Florida, Texas	NS	As cited in Green 1985.
Murphy 1965; Swenson 1975	earl Apr			nw Wyoming	NS	As cited in Howard & van Daele 1980.
Peterson (unpub.)	Mar			e Idaho 1979	NS	As cited in Howard & van Daele 1980.
Sherrod et al. 1977; Hensel & Troyer 1964	Mar		Apr	Alaska	NS	As cited in Green 1985.
Swenson et al. 1986	earl Mar	late Mar	late Apr	WY, MT, ID 1960-82	rivers, lakes	Habitats in and near Yellowstone Park.
US FWS 1989	late Oct	late Dec	March	se United States	NS	
Weaver 1980	mid Mar			w Wyoming	NS	As cited in Howard & van Daele 1980.
HATCHING						
Howard & van Daele 1980	late Mar		earl May	w Idaho 1979	NS	
Murphy 1965; Swenson 1975		late May		nw Wyoming	NS	As cited in Howard & van Daele 1980.
Peterson (unpub.)		late Apr		e Idaho 1979	NS	As cited in Howard & van Daele 1980.
Swenson et al. 1986	earl Apr	late Apr	late May	WY, MT, ID 1960-82	rivers, lakes	Habitats in and near Yellowstone Park.

Reference	Begin	Peak	End	Location	Habitat	Notes
Weaver 1980		earl May		w Wyoming	NS	As cited in Howard & van Daele 1980.
FLEDGING						
Hansen 1987		late Aug		se Alaska	riverine	
Harris et al. 1987	April		May	s Louisiana	various	
Howard & van Daele 1980	mid Jun		mid Jul	w Idaho 1979	NS	
Murphy 1965; Swenson 1975	mid Jun		mid Jul	nw Wyoming	NS	As cited in Howard & van Daele 1980.
Peterson (unpubl.)	mid Jul		late Aug	e Idaho 1979	NS	As cited in Howard & van Daele 1980.
Swenson et al. 1986	earl Jul	late Jul	mid Aug	WY, MT, ID 1960-82	rivers, lakes	Habitats in and near Yellowstone Park.
Weaver 1980	mid Jul		earl Aug	w Wyoming	NS	As cited in Howard & van Daele 1980.
FALL/BASIC MOLT						
McCollough 1989	spring		fall	n North America	NS	Begins in late spring, continues until early fall.
McCollough 1989	Nov - Dec		Apr - May	s North America	NS	Estimated timing for molt in southern populations; begins in late fall and continues until spring.
FALL MIGRATION						
Craig et al. 1988	mid Dec			Connecticut 1986	river	Arrival of wintering eagles.
Crenshaw & McClelland 1989	earl Oct	Nov	mid Dec	Montana 1980-85	Glacier Nat’l Park	Passing through of eagles going to wintering grounds; eagles utilized communal roosts.
Fielder & Starkey 1980	Oct			e Washington 1975-80	river	Arrival time of wintering eagles.

Reference	Begin	Peak	End	Location	Habitat	Notes
Fitzner et al. 1980	mid Nov	Dec - Jan		c Washington 1979-80	river	Arrival time of eagles wintering in Washington.
Grubb et al. 1983		July		nw Washington	coastal	Eagles leave breeding sites.
Grubb et al. 1983		June		c Arizona	desert scrub, river	Departure of eagles after breeding season.
Harris et al. 1987	Sept		Oct	Louisiana 1977-79	various	Arrival of eagles prior to breeding season.
Hodges et al. 1987	Nov	Dec	Jan	se Alaska 1979-82	river	Departure of 31 radiotagged eagles from the Chilkat River area.
Keister et al. 1987	late Oct	Dec - Jan		sc OR, n CA 1978-80	Klamath Basin	Arrival of wintering eagles.
McClelland 1973	earl Oct			Montana 1965-70	Glacier Nat'l Park	Arrival of wintering eagles; eagles are attracted to salmon runs.
Sabine 1981	late Oct	Jan & Feb		Illinois 1979-81	forest	Arrival of wintering eagles.
SPRING MIGRATION						
Craig et al. 1988			late Mar	Connecticut 1986	river	Departure of wintering eagles.
Fielder & Starkey 1980		earl Apr	mid Apr	e Washington 1975-80	river	Departure of wintering eagles.
Fitzner et al. 1980		earl Feb	earl Mar	c Washington 1979-80	river	Departure of wintering eagles.
Grubb et al. 1983		Dec		c Arizona	desert scrub, river	Arrival of eagles prior to breeding season.
Keister et al. 1987		Apr		sc OR, n CA 1978-80	Klamath Basin	Departure of wintering eagles.
McClelland 1973			late Dec	Montana 1965-70	Glacier Nat'l Park	Departure of wintering eagles; they leave when salmon are no longer available.

Reference	Begin	Peak	End	Location	Habitat	Notes
Sabine 1981	earl Mar			Illinois 1979-81	forest	Departure of wintering eagles.
Swenson et al. 1986	late Mar	earl Apr		WY, MT, ID 1960-74	rivers, lakes	Movement from wintering to breeding grounds (both are within Yellowstone National Park and vicinity).

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
BODY WEIGHT													
Bird & Clark 1983	A	M	-	-	113	2.0	SE g			25	Quebec, CAN	captive	
	A	F	-	-	120	5.3	SE g			26			
Bloom 1973	-	M	-	FA	103	6.7	SD g			12	s California	inland	Season: August through October. From largely migratory population; "U.S. 395 & vicinity" site.
	-	F	-	FA	115	8.6	SD g			16	1970-73		
Bloom 1973	-	M	-	WI	114	7.8	SD g			14	s California	inland	Month: February. From largely migratory population; Imperial Valley site.
	-	F	-	WI	132	13.1	SD g			70	1970-73		
Bloom 1973	-	M	-	WI	108	8.1	SD g			9	s California	coastal	Sample thought to represent resident population of kestrels.
	-	M	-	SP	110	5.3	SD g			3	1970-73		
	-	M	-	SU	106	9.6	SD g			8			
	-	M	-	FA	112	9.5	SD g			49			
	-	M	-	YR	111	9.3	SD g			69			
Bloom 1973	-	F	-	WI	124	8.9	SD g			24	s California	coastal	Sample thought to represent resident population of kestrels.
	-	F	-	SP	117	11.6	SD g			3	1970-73		
	-	F	-	SU	112	10.3	SD g			11			
	-	F	-	FA	119	8.8	SD g			73			
	-	F	-	YR	120	9.2	SD g			111			
Craighead & Craighead 1956	A	M	-	-	109		g			50	Michigan, Pennsylvania	NS	Tabulated by authors primarily from own data and unpublished data from the Pennsylvania Game Commission, but may include data from some other sources.
	A	F	-	-	119		g			67			
Gessaman & Haggas 1987	A	F	-	WI	138		g			9	Utah	open agricultural	(LI) = laying, incubating.
	A	F	LI	SP	124		g			9			
	A	F	-	FA	127		g			9			
Gessaman & Haggas 1987	A	M	-	WI	119		g			9	Utah	open agricultural	(I) = incubating.
	A	M	I	SP	108		g			9			
	A	M	-	FA	111		g			9			
Porter & Wiemeyer 1972	-	F	-	FA	142		g	125	159	13	northeastern US 1964	captive	Captive kestrels caught in the northeastern U.S.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Porter & Wiemeyer 1972	A	F	-	WI	138		g	130	142	5	Florida 1965-66	captive	Captive kestrels caught in Florida; thought to be wintering sparverius subspecies rather than resident paulus subspecies.
NESTLING WEIGHT													
Bird & Clark 1983	N	F	-	-	10	0.31 SE	g 1 day			8	Quebec, CAN	captive	Number of days presented in the unit column is age of nestling/fledgling birds. Birds were parent-reared in captivity; mass at day 31 was approximate mean adult weight for these birds. Values estimated from figure for days 7 through 31.
	N	M	-	-	11	0.12 SE	g 1 day			11			
	N	F	-	-	36		g 7 day			8			
	N	M	-	-	40		g 7 day			11			
	N	F	-	-	96		g 13 day			8			
	N	M	-	-	100		g 13 day			11			
	N	F	-	-	123		g 19 day			8			
	N	M	-	-	117		g 19 day			11			
	N	F	-	-	131		g 25 day			8			
	N	M	-	-	127		g 25 day			11			
	F	F	-	-	118		g 31 day			8			
	F	M	-	-	114		g 31 day			11			
BODY FAT													
Gessaman 1979	A	F	-	SP	8		g			1	Utah 1973-74	NS	Birds captured in: Spring = May; Summer = August; Fall (1) = early September; and Fall (2) = late September. (It appears that the figure upon which this information is based is mislabelled in the original; based on the text, we interpreted the dashed line to represent males, and the solid line to represent females.)
	A	M	-	SP	4.3		g			4			
	A	F	-	SU	4		g			2			
	A	M	-	SU	4		g			3			
	A	F	1	FA	5.5		g			3			
	A	M	1	FA	3.5		g			4			
	A	F	2	FA	12		g			2			
	A	M	2	FA	8		g			4			
Gessaman 1979	A	M	-	SP	4		% body wt				Utah 1973-74	NS	
	A	M	-	SU	3-4		% body wt						
	A	F	-	SU	3-4		% body wt						
	A	M	-	FA	5.3		% body wt						
	A	F	-	FA	7.0		% body wt						
METABOLIC RATE (KCAL BASIS)													
Gessaman & Haggas 1987	A	F	N	WI	327.2	5.72 SE	kcal/kg-d			9	Utah	open agricultural	(N) Nonbreeding; (LI) laying and incubating. Estimated from activity budgets of kestrels in the field and rates of energy expenditure with various activities measured in the lab.
	A	F	LI	SP	414.4	9.84 SE	kcal/kg-d			9			
	A	F	-	FA	368.7	17.0 SE	kcal/kg-d			9			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Gessaman & Haggas 1987	A	M	N	WI	386.4	9.41 SE	kcal/kg-d			9	Utah	open agriculture	(N) Nonbreeding; (I) incubating. Estimated as for the females (previous record).
	A	M	I	SP	337.6	16.8 SE	kcal/kg-d			9			
	A	M	-	FA	364.9	26.9 SE	kcal/kg-d			9			
Koplin et al. 1980	A	B	FL	WI	50.6		kcal/day	42.0	61.0		nw California	agricultural areas	Predicted on the basis of a metabolic model, measures of energy expended in various activities, and time-activity budgets observed in the field. (1) Estimated assuming body weight of 119 g.
	A	B	1	WI	420		kcal/kg-d	353	512				
Koplin et al. 1980	A	F	FL	WI	42.9		kcal/day			317hr	nw California	coastal	Estimated on the basis of observed food intake and assuming a body weight of 119 g.
	A	F	FL	WI	360		kcal/kg-d			317hr			
Rudolph 1982	A	M	BR	SU	354	26.4 SD	kcal/kg-d			4	California 1979	agricultural areas	Estimated daily energy expenditures during laying, incubation, and brooding using observed time budgets and multiples of basal metabolic rate (BMR) as recommended by King (1974). BMR was estimated from Zar (1968, 1969) equation for Falconifornes assuming 110 g for both males and females. Males performed most of the foraging.
	A	F	BR	SU	287	19.1 SD	kcal/kg-d			4			
Toland 1987	A	B	-	-	60		kcal/day				Missouri 1981-84	grassland, agricultural	Metabolic rate estimated from daily activity budget and multiples of basal metabolic rate. Time of year unspecified, however.
FOOD INGESTION RATE													
Barrett & Mackey 1975	A	M	-	SU	0.31		g/g-day			2	Ohio 1970	semi-natural enclosure	Two kestrels kept in vegetated enclosure and preyed on a marked group of deer mice and meadow voles for 13 days. Mean weight of kestrels = 100.8 g; mean temperature during study = 24 C. Ingestion of food in g/g-day calculated from the kcal values presented using the caloric equivalent of 1.37 kcal/g for small mammals (given by author).
	A	M	-	SU	420		kcal/kg-d			2			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Craighead & Craighead 1956	A	M	-	SU	0.223		g/g-day			40	s Michigan 1939-42	captive outside	N = number of days each bird was fed; one male bird (weight = 91 g) and two female birds (weights = 107 g and 112 g). Kestrels maintained using falconer techniques and fed lean raw beef supplemented with rodents, birds, and other natural prey. Mean outdoor temperature for males = 16 C; females = 22 C.
	A	F	-	SU	0.196		g/g-day	0.169	0.223	28			
Duke et al. 1976	A	-	-	-	0.14		g/g-day				Utah	captive outside	Kestrels fed mice; body weight was 105 g. Ambient temperature was 27 degrees C. As cited in Duke et al. 1987.
Koplin et al. 1980	A	B	1	WI	0.18		g/g-day				nw California	coastal, agricultural lands	(1) Biomass of vertebrates; (2) biomass of invertebrates; (3) total biomass (assuming kestrel body weight of 119 g). Estimated food intake by observing prey captured and by estimating prey weight on the basis of measured or reported values for identified prey (e.g., for shrews, mice) and by estimating weights from apparent size for unidentified prey (usually invertebrates).
	A	B	2	WI	0.11		g/g-day						
	A	B	3	WI	0.29		g/g-day						
Sparrowe 1972	A	-	-	-	15-20		g/day			15	Michigan 1968-69	captive	Amount of venison fed to captive kestrels that were kept at about 88-90% of their normal body weight during a prey-catching behavior study. Body weights not provided. Kestrels could also obtain up to 2 g a day of venison as a training "reward".
Wing & Wing 1939	A	-	-	-	0.22	0.05 SD	g/g-day	0.14	0.35	26	Tennessee 1937-38	captive in enclosed porch	Kestrel kept in 3 m by 4.5 m porch and fed lean beef. N = number of days bird was fed; months of study were December - March. Mean weight of kestrel was 113.8 g.

***** DIET *****

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Bohall-Wood & Collopy 1987	A	B	vertebrates (primarily lizards)	49				3 PR	Florida 1983	dry pine/oak woodlands (sandhill) - % wet weight of prey; observed captured	More prey captured per unit time than in agricultural/mixed hardwood areas. PR = pair.
			invertebrates	51							
Bohall-Wood & Collopy 1987	A	B	vertebrates	24				3 PR	Florida 1983	agricultural/mixed hardwoods - % wet weight of prey	
			invertebrates	76							
Collopy & Koplin 1983			Coleoptera				10.75	7	California	hayfields, pasture - % wet weight of prey observed captured	Two winters of data. Mean weights of prey species determined from a variety of sources, including literature. Prey captured identified with binoculars. 500 observation hours.
			other invertebrates				14.15				
			frog (Rana aurora)				7.95				
			other herpetofauna				12.20				
			Microtus calif.				30.15				
			Sorex vagrans				9.35				
			other mammals				11.45				
Craighead & Craighead 1956	A	B	meadow vole				59.5	84	s Michigan 1942,48	fields, woodlots - % frequency of occurrence; pellet analysis	Average of two years of study; pellets collected from a total of 4 kestrels. White-footed mice icludes Peromyscus maniculatus and P. leucopus. Kestrels also consumed insects when available, but number of insects could not be determined from pellets.
			white-footed mice				29.5				
			short-tailed shrew				1.3				
			small birds				10.9				
			insects				see note				
Craighead & Craighead 1956	B	B	meadow vole		57.3			220	Wyoming 1947	grasslands, forest - % of diet; from number of items in pellets, food at nest, regurgitated by nestlings	Season = spring and summer; data from 8 nests. Insects not included here because the number could not be determined, but of 299 pellets, 60% contained insects, and in 19% of the pellets insects comprised the majority of the food. White footed mice includes Peromyscus maniculatus and P. leucopus.
			white-footed mice		12.7						
			shrews		1.4						
			pocket gopher		2.7						
			ground squirrel		4.5						
			least chipmunk		1.8						
			jumping mice		0.5						
			small & medium sized birds		19.1						
			insects		see note						
Koplin et al. 1980	A	B	Lepidoptera				0.5	1533	nw California	agricultural areas - % wet weight of prey observed captured	Sample size = number of prey observed captured. (1) California vole; (2) western harvest mouse; (3) vagrant shrew.
			Orthoptera				1.0				
			Coleoptera				17.4				
			Lumbricidae				7.1				
			unidentified invertebrates				10.9				

(continued)

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Koplin et al. 1980 (continued)			Microtus californicus (1)				26.5				
			Reithodontomys megalotis (2)				1.9				
			Sorex vagrans (3)				8.5				
			Fringillid birds				2.9				
			snakes				4.1				
			Rana aurora				10.2				
			Hyla regilla				9.2				
Meyer & Balgooyen 1987	-	-	invertebrates				32.6	10	California	open areas, woods	Mean weights of prey species determined from a variety of sources, including literature. Prey captured identified with binoculars.
			mammals				31.7			-	
			birds				30.3			% wet weight of prey	
			reptiles				1.9			observed captured	
			other				3.5				
Toland 1987	A	B	vertebrates (mostly voles)		81.5			429	Missouri	disturbed grassland	Over the entire year, vertebrates comprised 67% of prey captured.
			invertebrates		18.5					- % by capture	Most studies report higher percentages of invertebrates than vertebrates in the diet of kestrels. (N = number of captures observed; number of different birds cannot be determined.)

***** POPULATION DYNAMICS *****

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
TERRITORY SIZE													
Craighead & Craighead 1956	A	B	-	SU	202	131 SD	ha	41	500	11	Wyoming 1947	grasslands, forest	Home range of breeding pairs. Based on records of observed movements plotted on maps.
Craighead & Craighead 1956	A	M	-	WI	466	109 SD	ha	300	601	6	s MI 1941-42, 1947-48	fields, woodlots	Seasonal home range estimates based on observations plotted on maps.
	A	F	-	WI	272		ha	168	376	2			
Craighead & Craighead 1956	A	B	-	SU	131	100 SD	ha	21	215	5	s Michigan 1942, 48	woodlots, fields	Home range of breeding pairs. Based on records of observed movements plotted on maps.
Enderson 1960	-	-	-	WI	452		ha				Illinois	NS	As cited in Mills 1975.
Haggas unpubl.	A	B	-	-	73		ha			18	n Utah	open agricultural	Home range estimate for all seasons based on observations; calculated from an average maximum diameter of 0.97 km. As cited in Gessaman and Haggas 1987.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Meyer & Balgooyen 1987	A	F	-	WI	31.6	10.7 SD	ha	18.7	42.0	5	California 1976-78	open areas, woods	Territory size.
	A	M	-	WI	13.1	2.0 SD	ha	9.7	14.8	5			
Mills 1975	A	B	NB	WI	154		ha		452	16	Illinois 1970-72	agricultural area; scattered trees	Territory size for birds seen at least 5 times was determined by connecting the extreme points of observation.
POPULATION DENSITY													
Craighead & Craighead 1956	A	B	BR	SU	0.0003		pairs/ha	0.0002	0.0004	2	s Michigan 1942, 48	fields, woodlots	Breeding pairs in a 9,600 ha township. N = number of years of data.
Craighead & Craighead 1956	-	B	-	FA	0.0007	0.0004 SD	N/ha	0.0005	0.0012	3	s MI 1941-42, 1946-49	fields, woodlots	N = number of years of data. Counts include adult and immature birds (not nestlings or fledglings) on a 9,300 ha township. Spring (1) = transition period when some wintering birds leave, others remain, and new birds arrive for the breeding season.
	-	B	-	WI	0.0005	0.0001 SD	N/ha	0.0005	0.0006	4			
	-	B	1	SP	0.0008		N/ha	0.0005	0.0010	2			
	-	B	-	SP	0.0010	0.0002 SD	N/ha	0.0008	0.0011	3			
	-	B	-	SU	0.0018		N/ha	0.0016	0.0020	2			
Craighead & Craighead 1956	A	B	BR	SU	0.0035		pairs/ha			1	Wyoming 1947	grasslands, forest	Breeding pairs in a 3,100 ha portion of Jackson Hole. N = number of years of data.
Toland & Elder 1987	-	-	-	-	0.0026		nests/ha	0.0023	0.0031		Missouri 1981-84	urban	26 square km sampled.
Toland & Elder 1987	-	-	-	-	0.0004		nests/ha	0.0003	0.0006		Missouri 1981-84	rural	90 square km sampled.
CLUTCH SIZE													
Bloom & Hawks 1983	-	-	-	-	4.3		eggs			38	California 1977-80	juniper, sagebrush	Counted in nest boxes.
Brown & Amadon 1968	-	-	-	-	4-5		eggs	3	7		NS	NS	
Carpenter et al. 1987	-	-	-	-	4-5		eggs				Quebec, CAN	captive	
Craighead & Craighead 1956	-	-	-	-	4.4		eggs		5	17	s MI, WY 1942, 1947-48	open areas, woods	

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
CLUTCHES/YEAR													
Carpenter et al. 1987	-	-	-	-	1		/year				Quebec, CAN	captive	Kestrels raise one brood per year, but will replace a lost clutch of eggs; sometimes third or fourth clutches can be induced by clutch removal.
Craighead & Craighead 1956	-	-	-	-	1		/year				s MI, WY 1942, 1947-48	open areas, woods	May replace clutch if lost early in the nesting cycle.
DAYS INCUBATION													
Brown & Amadon 1968	-	-	-	-	29-30		days				NS	NS	
Porter & Wiemeyer 1972	-	-	-	-	33.7	0.33 SE	days	33	35	6	Maryland	captive	
AGE AT FLEDGING													
Bird & Clark 1983	-	B	-	-	25		days			19	Quebec, CAN	captive	
Bloom & Hawks 1983	-	B	-	-	28-30		days			30	California 1977-80	juniper, sagebrush	From parents nesting in artificial nest boxes. N = number of successful nests.
Craighead & Craighead 1956	-	B	-	-	31		days				s Michigan 1942, 48	fields, woodlots	
Craighead & Craighead 1956	-	B	-	-	29		days				Wyoming 1947	grasslands, forest	
Porter & Wiemeyer 1972	-	B	-	-	29.3		days	27	32	6	Maryland 1967	captive	Florida caught parents.
Porter & Wiemeyer 1972	-	B	-	-	27.4		days	26	30	10	Maryland 1967	captive	Northeastern caught parents.
N FLEDGE/ACTIVE NEST													
Bloom & Hawks 1983	-	-	-	-	3.1		N/act nest			36	California 1977-80	juniper, sagebrush	Counted in nest boxes.
Craighead & Craighead 1956	-	-	-	-	3.2		N/act nest			6	s Michigan 1942, 48	woodlots, fields	

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Craighead & Craighead 1956	-	-	-	-	3.8		N/act nest			11	Wyoming 1947	grasslands, forest	
N FLEDGE/SUCCESSFUL NEST													
Bloom & Hawks 1983	-	-	-	-	3.7		N/suc nest			30	California 1977-80	juniper, sagebrush	Counted in nest boxes.
AGE AT SEXUAL MATURITY													
Carpenter et al. 1987	-	B	-	-	1		year				Quebec, CAN	captive	
ANNUAL MORTALITY													
Craighead & Craighead 1956	A	B	-	-	12		%/year				s MI, WY 1942, 1947-48	open areas, woods	Estimate for all raptor species in the two study areas. Juvenile = from fledging until next summer.
	J	B	-	-	88		%/year						
Henny 1972	A	B	-	-	46.0	4.6 SE	%/year				North America 1946-65	NS	Mortality rates for kestrels banded as nestlings during years indicated. Estimates based on band returns using the composite dynamic life table method. Juvenile = from fledging to the next breeding season.
	J	B	-	-	60.7		%/year						
LONGEVITY													
Carpenter et al. 1987	-	-	-	-			years		9		Quebec, CAN	captive	Number of years that birds have bred in captivity; many live longer but do not continue to breed successfully.

***** SEASONAL ACTIVITIES *****

Reference	Begin	Peak	End	Location	Habitat	Notes
MATING/LAYING						
Bloom & Hawks 1983	May 6	May 22	Jun 26	California 1977-80	juniper, sagebrush	
Brown & Amadon 1968	mid Mar		earl Jun	Florida	NS	

Reference	Begin	Peak	End	Location	Habitat	Notes
Brown & Amadon 1968	mid Apr		earl Jun	central US	NS	
Craighead & Craighead 1956	mid Apr			s Michigan 1942	woodlots, fields	
Craighead & Craighead 1956	mid May			Wyoming 1947	grasslands, forest	
Gessaman & Haggas 1987	earl Apr		mid May	n Utah	open agricultural	
Toland & Elder 1987		earl Apr		c Missouri 1982	farmland	Occurred 2 weeks later in 1984, probably due to heavy spring rains.
HATCHING						
Bloom & Hawks 1983	Jun 7	Jun 21	Jul 26	California 1977-80	juniper, sagebrush	
Craighead & Craighead 1956	mid May			s Michigan 1942, 48	woodlots, fields	
Craighead & Craighead 1956		mid June		Wyoming 1947	grassland, forest	
Gessaman & Haggas 1987	earl May		mid June	n Utah	open agricultural	Estimated from Figure 1.
Toland & Elder 1987		earl May		c Missouri 1982	farmland	Occurred 2 weeks later in 1984, probably due to heavy spring rains during mating season.
FLEDGING						
Craighead & Craighead 1956	mid Jun			s Michigan 1942-48	woodlots, fields	
Craighead & Craighead 1956		mid Jul		Wyoming 1947	grasslands, forest	
Gessaman & Haggas 1987	earl Jun		mid Jul	n Utah	open agricultural	Estimated from Figure 1.
Toland & Elder 1987		earl June		c Missouri 1982	farmland	Occurred 2 weeks later in 1984, probably due to heavy spring rains during mating season.

Reference	Begin	Peak	End	Location	Habitat	Notes
FALL/BASIC MOLT						
Gessaman & Haggas 1987	mid May		mid Sept	n Utah	open agricultural	
FALL MIGRATION						
Gessaman & Haggas 1987	earl Sep		earl Nov	n Utah	open agricultural	
SPRING MIGRATION						
Craighead & Craighead 1956	earl Mar			s Michigan 1942-48	woodlots, fields	Arrival of migratory birds for breeding season; many (especially males) wintered and nested in the same area.
Craighead & Craighead 1956	mid Apr			Wyoming 1947	grasslands, forest	Arrival of kestrels for breeding season.
Gessaman & Haggas 1987	mid Mar		mid Apr	n Utah	open agricultural	

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
BODY WEIGHT													
Brenner & Reeder 1985	A	B	-	-	308	2.8 SE	g			10	Wisconsin	lab	Commercial breeding stock - "Wisconsin strain."
Brenner & Reeder 1985	A	B	-	-	198	1.8 SE	g			10	Georgia	lab	Commercial breeding stock - "Georgia strain."
Brenner & Reeder 1985	A	B	-	-	197	2.7 SE	g			10	Pennsylvania	lab	Commercial breeding stock - "Pennsylvania strain."
Buss et al. 1947	B	B	-	FA	203.0		g			845	Wisconsin	NS	During fall and winter. As cited in Tomlinson 1975.
Case 1982	A	F	1	-	194.2		g			24	Nebraska	lab	Weight: (1) seven weeks prior to egg laying; (2) while laying. 15 hr light/9 hr dark photoperiod.
	A	F	2	-	214.8		g			24			
Gutherey et al. 1988	-	M	-	SP	158		g				se Texas 1981-83	e Rio Grande Plains	Mean sex-specific sample sizes by region ranged between 6 and 81 birds. Estimated from graph of body weight by month.
	-	M	-	SU	154		g						
	-	M	-	FA	156		g						
	-	M	-	WI	160		g						
	-	F	-	SP	170		g						
	-	F	-	SU	169		g						
	-	F	-	FA	158		g						
	-	F	-	WI	162		g						
Gutherey et al. 1988	A	M	-	SP	156		g				sw Texas 1981-83	w Rio Grande Plains	Mean sex-specific sample sizes by region ranged between 6 and 81 birds. Estimated from graph of body weight by month.
	A	M	-	SU	154		g						
	-	M	-	FA	156		g						
	A	M	-	WI	161		g						
	A	F	-	SP	165		g						
	A	F	-	SU	157		g						
	-	F	-	FA	157		g						
	A	F	-	WI	157		g						
Hamilton 1957	A	M	-	WI	189.2		g			16	c Missouri 1953-54	Ashland Wildlife Research Area	Adults are 18 months old or older.
	A	M	-	SP	178.7		g			7			
	A	M	-	SU	173.7		g			14			
	A	M	-	SU	178.4		g			7			
	A	F	-	WI	198.0		g			11			
	A	F	-	FA	180.7		g			7			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Hamilton 1957	J	M	-	WI	182.2		g			47	c Missouri	Ashland Wildlife	Juveniles defined as first year
	J	M	-	SP	169.3		g			72	1953-54	Research Area	adults (age 5 months to 18 months).
	J	M	-	SU	171.1		g			44			
	J	F	-	WI	178.2		g			40			
	J	F	-	SP	166.9		g			12			
	J	F	-	SU	175.3		g			3			
Nelson & Martin	A	M	-	-	173		g		249	899	United States	NS	Data from USFWS records (from bird
1953	A	F	-	-	170		g		255	692			banders, game bag investigations).
Nelson & Martin	A	B	1	-	162		g				Florida,	NS	(1) Florida; (2) Wisconsin. Study
1953	A	B	2	-	193		g				Wisconsin		states that records show a progressive increase in weight from south to north.
Robel 1969	A	B	-	FA	189.9	3.28 SE	g			8	Kansas 1961-67	farms, prairie	Collection months = October,
	J	B	-	FA	174.0	3.49 SE	g			45			January, and April.
	A	B	-	WI	193.9	4.56 SE	g			11			
	J	B	-	WI	193.9	3.90 SE	g			36			
	A	B	-	SP	190.0	4.98 SE	g			15			
	J	B	-	SP	184.1	2.99 SE	g			26			
Roseberry et al.	B	B	1	WI	183.2		g			102	s Illinois	agricultural	Captured from January - March.
1979	B	B	2	WI	185.5		g			90	1967-69		Year: (1) 1967; (2) 1968-69.
Roseberry &	B	M	-	WI	180		g			277	s Illinois	agricultural	Each seasonal value is an average
Klimstra 1971	B	M	-	SP	168		g			226	1948-49		of three monthly averages.
	B	M	-	SU	162		g			226			
	B	M	-	FA	175		g			108			
Roseberry &	B	F	-	WI	178		g			243	s Illinois	agricultural	Each seasonal value is an average
Klimstra 1971	B	F	-	SP	179		g			125	1948-49		of three monthly averages.
	B	F	-	SU	180		g			28			
	B	F	-	FA	173		g			85			
Roseberry &	A	M	-	WI	181		g		224	106	s Illinois	agricultural	Collected from November - March.
Klimstra 1971	A	F	-	WI	183		g		221	83	1948-69		Juveniles are young of the year
	J	M	-	WI	179		g		221	346			from their first November to the
	J	F	-	WI	175		g		220	312			following July.
Rosene 1969	A	M	-	WI	168		g	140	202	50	S Carolina	farm, forest	Juveniles includes birds between
	A	F	-	WI	166		g	144	195	54	1961-65		125 days and 15 months old.
	J	M	-	WI	164		g	141	189	109			Collected by hunters from December
	J	F	-	WI	163		g	132	196	114			through February.
Roseberry &	A	M	-	SU	162.8		g			385	s Illinois	agricultural	
Klimistra 1971	A	F	-	SU	180.4		g			72	1948-69		

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Simpson 1976	A	M	-	FA	161.6		g	142.6	178.9		sw Georgia	pine woods, farms	
	A	M	-	WI	180.6		g	154.0	221.0		1967-71		
	A	M	-	SP	170.1		g	130.5	210.0				
	J	M	-	WI	176.8		g	130.4	203.0				
	J	M	-	SP	165.6		g	97.1	203.0				
Simpson 1976	A	F	-	FA	160.2		g	135.5	182.5		sw Georgia	pine woods, farms	
	A	F	-	WI	177.9		g	142.0	220.0		1967-71		
	A	F	-	SP	169.3		g	139.0	197.3				
	J	F	-	WI	176.5		g	143.0	218.9				
	J	F	-	SP	164.5		g	129.0	195.0				
Stoddard 1931	B	M	-	WI	164.8		g			397	n FL, s GA	farm, woods, thicket	
	B	F	-	WI	165.5		g			342	1925-28		
Stoddard 1931	B	M	-	WI	177.2		g	148.8	212.7	138	S Carolina	island	
	B	F	-	WI	173.2		g	148.8	202.1	106	1927-28		
Tomlinson 1975	A	M	-	FA	168.6	3.04 SE	g	149	181	26	Sonora, MEX	mesquite, grasslands	Population of the endangered masked bobwhite; measured from October - January.
	A	F	-	FA	162.8	6.10 SE	g	146	195	19	1968-72		
BODY FAT													
Koerth & Guthery 1987	A	F	-	WI	10.6	0.8 SE	% dry wt	8.3	19.9	29	s Texas	plains	
	A	F	-	SP	9.7	0.3 SE	% dry wt	7.7	11.2	108	1982-83		
	A	F	-	SU	11.4	0.3 SE	% dry wt	9.0	12.8	98			
	A	F	-	FA	9.8	0.4 SE	% dry wt	7.1	14.0	50			
Koerth & Guthery 1987	A	M	-	WI	10.2	0.6 SE	% dry wt	9.0	11.9	34	s Texas	plains	
	A	M	-	SP	7.9	0.2 SE	% dry wt	6.5	10.0	134	1982-83		
	A	M	-	SU	9.9	0.3 SE	% dry wt	7.2	13.9	153			
	A	M	-	FA	9.8	0.4 SE	% dry wt	7.7	12.1	67			
McRae & Dimmick 1982	A	F	NB	WI	13.8	2.7 SD	% dry wt			11	Tennessee 1978	forest & farmland	Pre-breeding birds collected from Jan. 10 to March 10; breeding birds collected from April 10 through May 20.
	A	F	BR	SP	12.7	2.4 SD	% dry wt			5			
	A	M	NB	WI	15.5	2.8 SD	% dry wt			25			
	A	M	BR	SP	8.8	3.2 SD	% dry wt			21			
EGG WEIGHT													
Blem & Zara 1980	-	-	-	-	10.9	0.2 SE	g			22	Virginia	captive	Eggs obtained from local breeder.
Case 1982	-	-	-	-	8.7		g			367	Nebraska	captive	Produced by farm-raised birds.
Johnsgard 1988	-	-	-	-	10.7		g				NS	NS	

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units		Minimum	Maximum	N	Location	Habitat	Notes
Koerth & Guthery 1991	-	-	-	-	9.3	0.3 SE	g					Texas 1988	captive	No difference was found between eggs from wild-caught and domestic birds although domestic birds were significantly heavier.
Stoddard 1931	-	-	-	-	8.6		g		8.0	10.2	845	sw Georgia 1926-28	captive	Weight at laying.
Stoddard 1931	-	-	-	-	9.3		g				761	Virginia 1927	captive	Weight at laying.
CHICK WEIGHT														
Andrews et al. 1973	C	B	-	-	31.7		g	3 weeks			300	Florida	lab	Number of weeks in units column is age of chicks. Average of values for chicks fed from 20-30% protein in feed and 20-28% protein thereafter in weight gain maximization study.
	C	B	-	-	92.6		g	6 weeks			300			
	C	B	-	-	137.1		g	9 weeks			300			
Blem & Zara 1980	H	B	-	-	8.0	0.3 SE	g	day 0				Virginia	lab	Number of days in the units column is the age of juvenile birds; domestic quail.
	C	B	-	-	40		g	day 20						
	C	B	-	-	100		g	day 40						
	C	B	-	-	170		g	day 60						
	C	B	-	-	200		g	day 80						
Jones & Hughes 1978	H	B	1	-	9		g	day 0				South Carolina	lab	Day or week in unit column is age of young birds.
	C	B	2	-	47		g	3 weeks						
	C	B	3	-	117		g	6 weeks						
	C	B	4	-	143		g	9 weeks						
	C	B	5	-	175		g	16 weeks						
Stoddard 1931	H	B	-	-	6.26		g	day 1			47	sw Georgia 1924-29	captive and wild (farms, woods, thickets)	"Approximate normal weight"; ages presented in the units column.
	C	B	-	-	9-10		g	day 6						
	C	B	-	-	10-13		g	day 10						
	C	B	-	-	20-25		g	day 19						
	C	B	-	-	35-45		g	day 32						
	C	B	-	-	55-65		g	day 43						
	C	B	-	-	75-85		g	day 55						
	C	B	-	-	110-120		g	day 71						
	C	B	-	-	125-150		g	day 88						
	C	B	-	-	140-160		g	day 106						

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
CHICK GROWTH RATE													
Jones & Hughes 1978	C	B	1	-	1.8		g/day				South Carolina	lab	Ages: (1) hatching to 3 weeks; (2) 3 to 6 weeks; (3) 6 to 9 weeks; (4) 9 to 16 weeks.
	C	B	2	-	3.2		g/day						
	C	B	3	-	1.3		g/day						
	C	B	4	-	0.65		g/day						
Roseberry & Klimstra 1971	C	B	1	-	1.9		g/day				s Illinois 1948-69	agricultural	Growth rate from ages: (1) 1-74 days; (2) 75-138 days. Approximate weight at 74 days = 150 g; at 138 days = 178 g.
	C	B	2	-	0.42		g/day						
METABOLIC RATE (KCAL BASIS)													
Blem & Zara 1980	A	B	-	-	206.8		kcal/kg-d				Virginia	captivity	Metabolized energy for game birds in cages. For juveniles, metabolized energy/bird-day (in kcal) = 37.3(wt)**0.20 - 0.013 (age in days) + 0.03(age)*(wt change). Adult weight = 205 g; juvenile weight (at 65 days) = 175 g. Asymptotic weight (used for adults) was reached at 84 days.
	J	B	-	-	262.9		kcal/kg-d						
Case 1982	A	F	1	-	183.3		kcal/kg-d			24	Nebraska	lab	Metabolized (existence) energy requirements of farm-raised birds: (1) 7 weeks prior to laying (mean wt. = 194.2 g); (2) during laying (mean wt. = 214.8 g).
	A	F	2	-	243.9		kcal/kg-d			24			
Case & Robel 1974	A	M	1	WI	261		kcal/kg-d			20	Kansas 1969	lab	Existence energy based on male values; females require additional "productive energy" when laying. Temperature: (1) 0 C; (2) 30 C. Photoperiod: winter (WI) = 10L:14D; summer = (SU) 15L:9D. Mean weight of birds = 188.6 g.
	A	M	2	WI	125		kcal/kg-d			20			
	A	M	1	SU	348		kcal/kg-d			20			
	A	M	2	SU	155		kcal/kg-d			20			
Case 1973	A	F	1	-	147		kcal/kg-d				Kansas	lab	Existence metabolism at (1) 20 C and (2) 35 C. Values are for individually caged birds; values for caged coveys (8 individuals) were slightly higher. Mean weight of birds: for 20 C trials = 172.9 g; for 35 C trials = 189.7 g. Photoperiod = 10L:14D.
	A	F	2	-	127		kcal/kg-d						

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Case 1973	A	F	1	-	45		kcal/day				Kansas	lab	Existence metabolism for individually caged quail at temperature of: (1) 5 C; (2) 15 C; (3) 20 C; (4) 25 C; (5) 35 C. Regression equation for individually caged quail: Y (kcal/day) = 49.498 - 0.872(C). Values for coveys (8 individuals) were slightly higher for all temperatures from 15 - 35 C; at 5 C the covey value was lower. Mean body weights during trials ranged from 173 - 190 g.
	A	F	2	-	37		kcal/day						
	A	F	3	-	28		kcal/day						
	A	F	4	-	29		kcal/day						
	A	F	5	-	22		kcal/day						
Robel et al. 1979b	A	B	FL	WI	74		kcal/day				Kansas	NS (wild)	Energy of free living (FL) at 2 C with a photoperiod of 10L:14D. Estimate based on doubling the 49 kcal/day requirement of caged birds and incorporating an estimate of the metabolic advantage of covey behavior.
FOOD INGESTION RATE													
Blem & Zara 1980	A	B	-	-	370		kcal/kg-d				Virginia	lab	Gross energy intake estimates for adults (mean weight of 205 g) and 65 day old juveniles (mean weight 175 g).
	J	B	-	-	460		kcal/kg-d						
Koerth & Guthery 1990	A	B	-	WI	0.093	0.0032 SE	g/g-day			10	s Texas 1988	lab	Food intake (water and food provided ad libitum) of domestic and wild-caught birds exposed to conditions typical of s Texas. Fed commercial game bird food - % dry matter: winter = 90.5; spring = 92.1; summer = 95.7; and fall = 90.2. Temperature and relative humidity for each season: WI = 13 C, 72%; SP = 23 C, 69%; SU = 30 C, 49%; and FA = 22 C, 66%. The protein content of the food was adjusted seasonally to reflect the average crude protein of the native diet.
	A	B	-	SP	0.067	0.0021 SE	g/g-day			11			
	A	B	-	SU	0.079	0.0061 SE	g/g-day			12			
	A	B	-	FA	0.072	0.0017 SE	g/g-day			12			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Nice 1910	A	B	-	FA	0.09		g/g-day	0.07	0.12		Massachusetts	captive	Captive raised; mean weight of birds was 170 g. Fed weed seeds. Consumption measured from October through February. As cited in Handley 1931.
Robel et al. 1974	A	-	-	WI	17		g/day				Kansas	NS (wild)	As cited in Robel et al. 1979b.
Robel et al. 1979a	A	B	-	WI	0.10	0.002 SD	g/g-day			3	Kansas	lab	Game farm birds fed laboratory mash (P-18). Lab conditions simulated midwinter in Kansas; Temp. = 1 C, photoperiod = 10L:14D. Mean weight of birds = 192 g.
	A	B	-	WI	409.7	9.2 SD	kcal/kg-d			3			
Robel et al. 1979a	A	B	-	WI	0.089		g/g-day			12	Kansas	lab	Same conditions as above except value is mean for diets of corn and sorghum. Mean weight at beginning of trial was 178.3 g.
	A	B	-	WI	373		kcal/kg-d			12			
Robel 1969	A	B	-	WI	587		kcal/kg-d				Kansas 1961-67	farms, prairie	Gross energy intake calculated from the average volume of the crop contents in shot birds (using 2.30 kcal/cc for energy estimates) and multiplying this by the number of 1.5 hour (daylight) feeding periods possible during that time of year.
	J	B	-	WI	571		kcal/kg-d						
	A	B	-	FA	657		kcal/kg-d						
	J	B	-	FA	598		kcal/kg-d						
	A	B	-	SP	519		kcal/kg-d						
	J	B	-	SP	327		kcal/kg-d						
WATER INGESTION RATE													
Koerth & Guthery 1990	A	M	-	WI	0.115	0.020 SD	g/g-day				s Texas 1988	lab	Water intake (from free water and food - both provided ad libitum) of domestic and wild-caught birds exposed to conditions typical of s Texas. Fed commercial game bird food - % dry matter: winter = 90.5; spring = 92.1; summer = 95.7; and fall = 90.2. Temperature and relative humidity for each season: WI = 13 C, 72%; SP = 23 C, 69%; SU = 30 C, 49%; and FA = 22 C, 66%. Values estimated from figure; N = approximately 12 for each trial. For food ingestion rate of the same birds see authors' data under "food ingestion rate."
	A	F	-	WI	0.106	0.010 SD	g/g-day						
	A	M	-	SP	0.093	0.012 SD	g/g-day						
	A	F	-	SP	0.086	0.013 SD	g/g-day						
	A	M	-	SU	0.100	0.023 SD	g/g-day						
	A	F	-	SU	0.131	0.037 SD	g/g-day						
	A	M	-	FA	0.101	0.013 SD	g/g-day						
	A	F	-	FA	0.102	0.044 SD	g/g-day						

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Koerth & Guthery 1990	A	M	-	WI	0.068	0.007	SD g/g-day				S Texas 1988	lab	Minimum water intake (from free water and food) required daily for mass stasis. Diet and lab conditions are the same as those described above. Authors suggest that the minimum need of free ranging birds may be 2-3 times higher than those for captives. Values estimated from figure.
	A	F	-	WI	0.072	0.003	SD g/g-day						
	A	M	-	SP	0.034	0.008	SD g/g-day						
	A	F	-	SP	0.038	0.004	SD g/g-day						
	A	M	-	SU	0.049	0.010	SD g/g-day						
	A	F	-	SU	0.060	0.015	SD g/g-day						
	A	M	-	FA	0.040	0.013	SD g/g-day						
	A	F	-	FA	0.041	0.006	SD g/g-day						

***** DIET *****

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Baldwin & Handley 1946	B	B	native & naturalized legumes			9.7	39.0		Virginia 1929-31	NS - % dry volume; crop contents	Collected from hunters. Fall = November; winter = December and January.
			ragweed			31.5	16.2				
			cultivated legumes			12.7	13.9				
			cultivated grains			16.6	8.9				
			mast			12.4	8.3				
			misc. seeds			6.4	6.6				
			fruits			4.8	4.0				
			forage			0.5	2.1				
			grasses			0.6	0.7				
			Orthoptera			3.4	0.3				
			misc. animal			1.4	0.4				
			(SAMPLE SIZE)			(115)	(380)				
Baldwin & Handley 1946	B	B	native & naturalized legumes				24.8	108	e Virginia 1929-31	coastal plain - agricultural - % dry volume; crop contents	Collected from hunters from November through January. Major types of crops grown in this area = peanuts, cotton, and truck crops.
			ragweed				15.0				
			cultivated legumes				31.4				
			cultivated grains				9.7				
			mast				6.9				
			misc. seeds				4.7				
			fruits				3.6				
			forage				1.3				
			grasses				1.2				
			Orthoptera				0.6				
			misc. animal				0.8				
Baldwin & Handley 1946	B	B	native & naturalized legumes				36.9	250	c Virginia 1929-31	piedmont section - agricultural - % dry volume; crop contents	Collected from hunters from November through January. Major types of farms in this area = dairy, general, tobacco, fruit, and livestock.
			ragweed				20.6				
			cultivated legumes				10.2				
			cultivated grains				5.7				
			mast				9.4				
			misc. seeds				6.9				

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Baldwin & Handley 1946 (continued)			fruits				6.2				
			forage				1.5				
			grasses				0.8				
			Orthoptera				1.4				
			misc. animal				0.4				
Baldwin & Handley 1946	B	B	native & naturalized legumes				17.9	132	w Virginia 1929-31	mountain section - agricultural - % dry volume; crop contents	Collected from hunters from November through January. Major types of farms in this area = general and livestock.
			ragweed				27.5				
			cultivated legumes				3.4				
			cultivated grains				24.9				
			mast				12.9				
			misc. seeds				8.4				
			fruits				2.2				
			forage				1.1				
			grasses				0.2				
			Orthoptera				0.6				
			misc. animal				0.9				
Campbell-Kissock et al. 1985	B	B	seeds of forbs		3.45	19.01	11.97		sw Texas 1979-80	grasslands - drought conditions - aggregate % wet volume; crop contents	Collection times: summer = June 1980; fall = September 1980; winter = late October 1979 - early February 1980.
			seeds of bulblets of grass & grasslike		51.66	42.93	4.85				
			seeds and fruits of woody plants		9.73	-	1.37				
			unident. seeds		4.55	0.03	2.26				
			green vegetation		4.81	1.81	72.38				
			animals		25.80	36.23	6.48				
			sample size		*12*	*9*	*91*				
Handley 1931	A	B	total plant foods	87.16	78.67	79.71	96.80		se US 1924-29	NS - % volume; crop and gizzard contents	Items that shrink from normal size when dried were measured wet (e.g., fruit) ; those that swell when wet were measured dry (e.g., seeds). Items comprising a mean of less than 2% in all seasons not included here. Each seasonal value is the mean of three monthly values.
			(miscell. seeds)	(21.24)	(6.04)	(11.07)	(2.61)				
			(legumes)	(15.19)	(3.93)	(10.08)	(31.47)				
			(senna)	(7.21)	(0.42)	(0.17)	(12.78)				
			(cultivated plants)	(2.12)	(2.07)	(5.34)	(2.61)				
			(grasses)	(3.08)	(11.28)	(25.95)	(2.29)				
			(sedges)	(1.08)	(1.22)	(2.36)	(1.08)				
			(mast)	(14.12)	(0.17)	(0.49)	(27.99)				
			(spurges)	(0.08)	(1.21)	(5.47)	(0.36)				
			(fruits)	(11.07)	(45.76)	(11.33)	(9.49)				
			(forage plants)	(11.52)	(0.27)	(0.29)	(5.17)				
			animal foods	12.84	19.64	20.29	3.20				
			(Orthoptera)	(3.15)	(7.50)	(16.62)	(2.43)				
			(Hemiptera)	(2.83)	(4.35)	(0.58)	(0.08)				
			(Coleoptera)	(4.63)	(6.29)	(0.81)	(0.19)				
			sample size	*86*	*92*	*129*	*1,352*				

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Handley 1931	J	B	total animals		25.91			34	GA, FL 1924-29	NS - % volume; crops and gizzards	Young birds 2 weeks to three months old. Items that shrink when dry were measured wet; those that swell when wet were measured dry. Season = May 1 to November 1. Items comprising less than 1% not listed here.
			(grasshoppers and their allies)		(8.18)						
			(beetles)		(5.76)						
			(bugs)		(4.68)						
			(lepidopterans)		(3.85)						
			total plants		74.09						
			(fruit)		(16.78)						
			(grasses)		(36.12)						
			(legumes)		(4.97)						
			(spurges)		(4.47)						
			(cult. plants - non legumes)		(1.88)						
			(sedges)		(2.21)						
			(misc. seeds)		(7.60)						
Handley 1931	J	B	total animals		83.7			20	GA, FL 1924-29	NS - % volume; crops and gizzards	Young birds 0-2 weeks old. Items that shrink when dry were measured wet; those that swell when wet were measured dry.
			(grasshoppers and their allies)		(26.7)						
			(beetles)		(31.7)						
			(spiders)		(8.0)						
			(lepidopterans)		(7.9)						
			(bugs)		(7.1)						
			(misc. insects)		(1.8)						
			(slugs and snails)		(0.5)						
			plant foods		16.3						
			(blackberries)		(9.6)						
			(seeds of grasses and sedges)		(4.4)						
			(seeds of spurge)		(1.1)						
			(misc. seeds, bits of vegetation)		(0.9)						
Heitmeyer 1980	B	B	soybeans				51.1	137	ne Missouri 1977	farms, woodlands - % volume; crop contents	Collected from hunters from November through January. Items comprising less than 1% not included here.
			weed seeds				6.5				
			(nodding foxtail)				(2.2)				
			(common ragweed)				(1.4)				
			corn				24.8				
			milo				15.7				
			animal matter				1.4				
Hurst 1972	J	B	beetle		3.6			126	Mississippi 1968-71	dense sedges, forbs and grasses - number of insects per chick; gizzard and crop contents	Insect foods only; listed in decreasing order of importance (based primarily on estimated weights). Chicks aged 2-15 days released on previously burned plots.
			true bug		2.2						
			leaf-hopper		1.7						
			spider		1.2						
			grasshopper		1.2						
			ant		3.6						
			fly		0.7						

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Hurst 1972	J	B	beetle		3.2			38	Mississippi 1968-71	pine forest - number of insects per chick; gizzard and crop contents	Insect foods only; listed in decreasing order of importance (based primarily on estimated weights). Chicks aged 1-20 days (mostly 6 days).
			leaf-hopper		4.2						
			ant		6.4						
			larval forms -mostly lepidopterans		2.0						
			spider		5.2						
			true bug		1.9						
			grasshopper		2.5						
			fly		1.9						
Judd 1905	A	B	plant matter				83.59	918	US, CAN, MEX	NS - % (measure not specified); stomach contents	All seasons, but mostly fall and winter. Also contained unspecified amounts of sand and gravel. As cited in Bent 1932.
			(grain)				(17.38)				
			(seeds)				(52.83)				
			(fruit)				(9.57)				
			animal matter				16.41				
			(beetles)				(6.92)				
			(grasshoppers)				(3.71)				
			(bugs)				(2.77)				
			(caterpillars)				(0.95)				
			(other)				(2.06)				
Korschgen 1948	B	B	Korean lespedeza				5.9	201	Missouri 1941-42	lowland region - croplands - % dry volume; crop contents	Collected from hunters in November and December. Items comprising < 1.5% not included here.
			corn				27.4				
			common ragweed				3.3				
			sorghum cane				3.8				
			oaks				18.1				
			sassafras				4.9				
			soybean				12.1				
			croton				1.8				
			cowpea				7.5				
Korschgen 1948	B	B	Korean lespedeza				25.9	2,722	Missouri 1941-42	ozark region - crops forest, pasture - % dry volume; crop contents	Collected from hunters in November and December. Volumes are means for three Ozark sites. Items comprising < 2% not included here.
			corn				7.4				
			common ragweed				12.2				
			sorghum cane				6.5				
			oaks				7.9				
			sassafras				4.0				
			beggars ticks				3.1				
			croton				2.4				
			small wild bean				2.0				
			ashes				2.1				
Korschgen 1948	B	B	Korean lespedeza				6.3	2,549	Missouri 1941-42	prairie region - cropland, pasture - % dry volume; crop contents	Collected from hunters in November and December. Volumes are means for four Prairie sites. Items comprising < 1% not included here.
			corn				31.6				
			common ragweed				12.7				
			sorghum cane				21.8				
			oaks				3.4				
(continued)			soybeans				3.5				

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Korschgen 1948 (continued)			Japanese clover				1.4				
			trailing wild bean				1.3				
			small wild bean				1.3				
			horseweed				1.1				
			hemp				1.2				
Lehmann 1984	B	B	total seeds	60.88	79.04	70.45	50.99		s Texas 1949-51	semi-prairie, brushland	Greens = leaves, stems, buds and flowers. Data is provided in great detail in original paper. Age of quail; 80 = 1+ years, 114 = full grown in first year; 6 = 5 days to 3 weeks old.
			(weeds)	(43.64)	(33.71)	(29.97)	(34.29)			-	
			(woody plants)	(4.03)	(20.51)	(39.74)	(9.49)			% dry volume; crop contents	
			(grasses)	(13.21)	(24.82)	(0.74)	(7.21)				
			greens	27.39	4.90	3.44	10.31				
			insects	8.03	14.20	17.85	23.33				
			cultivated grain and miscellaneous	3.70	1.86	8.26	15.37				
			sample size	*51*	*39*	*27*	*83*				
Martin et al. 1951	A	B	ragweed				25-50		ne United States	NS	Caught year-round, N=: winter = 124; spring = 2; summer = 25; fall = 24.
			corn				10-25			-	
			smartweed				10-25			approx. % diet; stomach contents	
			bristlegrass				5-10				
			wheat				5-10				
			grape				2-5				
			hogpeanut				2-5				
			blackberry				2-5				
			ash				2-5				
			poison ivy				2-5				
			sumac				2-5				
			oak				2-5				
Martin et al. 1951	A	B	Lespedeza				25-50	7668	se United States	NS	All caught in winter except 29 caught in summer.
			beggarweed				5-10			-	
			oak				5-10			approx. % diet; stomach contents	
			partridge pea				5-10				
			cowpea				5-10				
			ragweed				2-5				
			pine				2-5				
			milkpea				2-5				
			paspalum				2-5				
			soybean				2-5				
Martin et al. 1951	A	B	ragweed				25-50	105	ne prairies, US	NS	From three seasons, N =: winter = 53; summer = 10; fall = 42.
			corn				25-50			-	
			bristlegrass				10-25			approx. % diet; stomach contents	
			sunflower				5-10				
			wheat				2-5				
			sorghum				2-5				
			knotweed				2-5				
			panicgrass				2-5				
			poison ivy				2-5				

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Martin et al. 1951	A	B	sorghum				10-25	699	Texas,	NS	
			doveweed				5-10		Oklahoma	-	
			oak				5-10			approx. % diet;	
			panicgrass				5-10			stomach contents	
			ragweed				5-10				
			corn				5-10				
			sunflower				5-10				
			milkpea, downy				2-5				
			Lespedeza				2-5				
			wildbean				2-5				
			sumac				2-5				
Robel 1969	B	B	sorghum	19.7		10.7	27.5		Kansas 1961-67	farms, prairie	Habitat planted with corn, sorghum.
			sunflower	0.1		21.1	9.1			-	and wheat to improve food supply.
			western ragweed	0.1		10.0	4.6			% dry volume; crop	Data provided by month: spring =
			sumac	9.2		0.3	13.5			contents	mean of March and April; fall and
			corn	28.7		0.1	4.9				winter = mean of three monthly
			acorn meat	4.2		4.7	2.4				values. Plants comprising less than
			giant ragweed	0.8		2.1	3.0				3% in all seasons combined into
			osage orange	6.8		-	2.9				"other plants".
			dogwood	-		3.5	0.7				
			black locust	5.5		0.0	2.7				
			riverbank grape	-		1.2	0.8				
			native grasses	3.0		19.1	3.9				
			other plants	5.2		6.5	13.0				
			animal matter	9.8		14.0	1.3				
			debris	4.2		0.4	3.7				
			(SAMPLE SIZE)	(106)		(266)	(219)				
Rosene 1969	B	B	sesbania				17.1	1,400	sc Alabama	plantation managed	All items were seeds except green
			partridge peas				16.6		1950-62	for quail	leaves. Collected during the
			trailing wild bean				11.0			-	hunting season.
			beggar weeds				9.0			% volume; crop	
			lespedezas				9.7			contents	
			loblolly pine				5.5				
			green leaves				5.2				
			butterfly pea				2.4				
			corn				2.2				
			milk pea				1.8				
			other items				19.5				
Wood et al. 1986	B	B	croton species	6.5	46.4				s Texas	plains	Summarized from original.
			grasses	15.7	8.8				1982-83	-	
			(bristlegrass)	(2.1)	(4.5)					% dry weight;	
			(dicanthelium)	(7.8)	-					crop contents	
			(thin paspalum)	(3.8)	-						
			legumes	17.5	7.9						
			(leavenworth vetch)	(11.4)	(1.1)						
			(hoary milkpea)	(2.0)	(3.4)						
(continued)			(roundleaf scurfpea	(4.1)	-						

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat	Notes
Wood et al. 1986 (continued)			arthropods	14.1	8.4						
			snails	1.9	-						
			fruits	6.4	4.0						
			(ground cherry)	(6.4)	(1.9)						
			miscellaneous plants	22.1	7.9						
			(greens, flowers)	(6.0)	-						
			(yellow wood sorrel	(5.1)	-						
			(dayflower)	-	(6.1)						
			(spiny pricklepoppy	(4.2)	-						
			other foods	8.7	10.6						
			sand, gravel, unidentified seed husks	5.5	4.4						
			unknown	1.7	1.0						
			sample size	*130*	*159*						

***** POPULATION DYNAMICS *****

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
HOME RANGE SIZE													
Bartholemew 1967	B	B	-	WI	15.4		ha/covey	12.1	18.6	4	s Illinois	NS	Determined using radiotelemetry. As cited in Yoho and Dimmick 1972.
Crim & Seitz 1972	A	B	1	SU	3.6		ha/summer				Iowa	State Game Area	Individual home range: (1) for entire summer (763 m long by 473 m wide); (2) daily in summer (227 m long by 71 m wide). As cited in Schroeder 1985.
	A	B	2	SU	1.6		ha/day						
Roseberry & Klimstra 1984	B	B	1	WI	15		ha/covey	12	19	4	s Illinois	agricultural	Winter conditions of (1) average snowfall; (2) prolonged snow cover.
	B	B	2	WI	9		ha/covey			4	1953-80		
Rosene 1969	B	B	1	WI	3.3		ha/covey	2	9	166	Alabama	farms, forest	Measurements made during four winters; based on repeated searches and plotting of locations on maps. Plantation: (1) Maytag; (2) Wyecott.
	B	B	2	WI	4.4		ha/covey	2	12	300	1947-58		
Rosene 1969	B	B	1	WI	7.2		ha/covey	2	19	164	S Carolina	farms, forest	Measurements made during eight winters; based on repeated searches and plotting of locations on maps. Plantation: (1) Oakland Club; (2) Friendfield.
	B	B	2	WI	6.0		ha/covey	2	31	524	1947-58		

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Urban 1972	A	M	1	SU	7.6	5.0 SD	ha			11	s Illinois	idle farms, woods,	Monthly ranges from May -
	A	M	2	SU	16.7	9.5 SD	ha			9	1969	brush, cornfields	September; radiotagged individuals.
	A	F	1	SU	6.4	4.0 SD	ha			5			Breeding status: males (1) mated,
	A	F	2	SU	15.6	9.1 SD	ha			4			and (2) unmated; females (1)
													nesting, and (2) postnesting.
Urban 1972	B	B	-	SU	8.5	6.0 SD	ha/covey			4	s Illinois	idle farms, woods,	Radiotagged coveys. Monthly ranges
	B	B	1	FA	9.3	6.8 SD	ha/covey			7	1969	brush, cornfields	in fall: (1) September; (2)
	B	B	2	FA	16.6	7.1 SD	ha/covey			11			October; (3) November.
	B	B	3	FA	9.1	1.7 SD	ha/covey			7			
Wiseman & Lewis 1981	B	B	1	-	3.6	1.0 SE	ha/covey				Oklahoma 1975-76	pasture, shrubs, woodlands, stream channel	Size did not vary from fall through spring but did seem to vary with population density. Density at study sites (in fall - winter): (1) 0.30 - 0.34/ha; (2) 0.16 - 0.20.
	B	B	2	-	5.1	0.7 SE	ha/covey						
Yoho & Dimmick 1972	B	B	-	WI	6.8	2.9 SD	ha/covey	4.0	11.7	5	Tennessee 1970	woods, old fields, cultivated fields	Radiotagged 2-3 birds per covey, located coveys from 69-134 times each from January through March.
POPULATION DENSITY													
Brennan (unpubl.)	B	B	-	-	2		N/ha				s Mississippi	NS	Areas utilizing "good quail habitat management." As cited in Brennan 1991.
Craighead & Craighead 1956	B	B	1	WI	0.061		N/ha			2,073	sc Michigan	farms, woodlots	Year: (1) 1942; (2) 1948. Authors thought that severe winter weather led to the local disappearance of bobwhites in spring of 1948. N = number of hectares sampled.
	B	B	1	SP	0.046		N/ha			2,073	1942, 48		
	B	B	2	WI	0.015		N/ha			2,073			
	B	B	2	SP	0		N/ha			2,073			
Guthery 1988	B	B	1	FA	4.78	0.407 SE	N/ha			82	s Texas	mixed brush	Hidalgo study site (1) 1984; (2)
	B	B	2	SP	1.62	0.062 SE	N/ha			82	1984-86	rangeland	1985; (3) 1986. N = number of km of
	B	B	2	FA	5.00	0.300 SE	N/ha			82			transect sampled.
	B	B	3	SP	2.18	0.205 SE	N/ha			82			
Guthery 1988	B	B	-	SP	0.102	0.0003 SE	N/ha			382	s Texas	upland rangeland	Dickens, King study site. N =
	B	B	-	SU	0.352	0.0038 SE	N/ha			573	1981-83		number of km of transect sampled.
	B	B	-	FA	0.208	0.0031 SE	N/ha			382			
	B	B	-	WI	0.164	0.0013 SE	N/ha			282			
Kellogg et al. 1970	B	B	1	FA	4.6		N/ha			453	Florida 1968-69	fields, woodlands	Method for estimate: (1) walking census; (2) released banded birds, then shot a random sample and estimated density from ratio of banded to unbanded in shot group. N = size of site in ha.
	B	B	2	WI	3.0		N/ha			453			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Lehmann 1984	-	B	-	WI	2.5		N/ha				s Texas 1949	tasjillo-running mesquite brush	Maximum density observed in study (natural conditions); determined by car census.
Lehmann 1984	-	B	-	WI	0.73		N/ha			2,053	s Texas 1950	medium grass prairie	N = number of hectares censused (by car). Winter = February; summer = August.
	-	B	-	SU	0.39		N/ha			1,038			
Lehmann 1984	-	B	-	WI	0.21		N/ha			3,387	s Texas 1950	open mesquite brushland	N = number of hectares censused (by car). Winter = February; summer = August.
	-	B	-	SU	0.094		N/ha			3,387			
Lehmann 1984	-	B	-	WI	0.40		N/ha			1,000	s Texas 1950	tasjillo-running mesquite brush	N = number of hectares censused (by car). Winter = February; summer = August.
	-	B	-	SU	0.44		N/ha			1,000			
Lehmann 1984	-	B	-	WI	0.48		N/ha			1,055	s Texas 1950	tall grass prairie	N = number of hectares censused (by car). Winter = February; summer = August.
	-	B	-	SU	0.63		N/ha			2,098			
Lehmann 1984	-	B	-	WI	0.43		N/ha			1,698	s Texas 1950	short-grass prairie	N = number of hectares censused (by car). Winter = February; summer = August.
	-	B	-	SU	0.21		N/ha			1,670			
Lehmann 1984	-	B	-	WI	0.25		N/ha			1,821	s Texas 1950	bulldozed brushland	N = number of hectares censused (by car). Winter = February; summer = August.
	-	B	-	SU	0.057		N/ha			1,821			
McRae & Dimmick 1982	B	B	-	WI	1		N/ha				Tennessee 1978	forest & farmland	Rough estimate.
Roseberry & Klimstra 1984	B	B	-	FA	0.62	0.21 SD	N/ha	0.28	1.0		s Illinois 1953-80	agricultural	27 years of data on hunted population at the Carbondale research area; censused in November and March.
	B	B	-	SP	0.21	0.061 SD	N/ha	0.11	0.34				
Roseberry et al. 1979	B	B	-	FA	0.63	0.24 SD	N/ha	0.28	0.92	8	s Illinois 1964-73	agricultural	Carbondale research area - hunted population. N = number of seasonal estimates. Censused in November and March.
	B	B	-	SP	0.24	0.05 SD	N/ha	0.18	0.33	9			
Roseberry et al. 1979	B	B	1	FA	1.36		N/ha				s Illinois 1965-73	agricultural	SIU Farms site - nonhunted population. Years: (1) 1965-66; (2) 1968-69; (3) 1972-73. Fall = November, spring = March. Population decline thought to be due to a rapid deterioration of habitat due to changes in farming practices.
	B	B	1	SP	0.85		N/ha						
	B	B	2	FA	0.61		N/ha						
	B	B	2	SP	0.22		N/ha						
	B	B	3	FA	0.23		N/ha						
	B	B	3	SP	0.11		N/ha						

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Rosene 1969	B	B	-	WI	1.63	0.49 SD	N/ha	0.93	2.28	4,830	S Carolina 1957-67	farms, woods	Groton plantation pre-hunting season density. Area managed for quail and hunted from December - February. N = number of ha censused. Value is mean of ten years of data.
Rosene 1969	B	B	-	WI	0.63	0.18 SD	N/ha	0.37	0.88	707	S Carolina 1952-57	farms, woods	Oakland Club pre-hunting season density. Area managed for quail and hunted from December - February. N = number of ha censused. Value is mean of six years of data.
Simpson 1976	B	B	1	FA	5		N/ha				sw Georgia 1967-71	pine woods, farms	(1) Intensively managed area; (2) areas with little or no management.
	B	B	2	FA	0.6		N/ha						
Smith et al. 1982	B	B	1	WI	3.65	2.22 SD	N/ha	1.7	7.6		Florida 1970-79	pine woods	Ten years of data; minimum and maximum are yearly means. (1) Northern study site; (2) southern study site.
	B	B	2	WI	2.25	1.16 SD	N/ha	0.6	3.9				
CLUTCH SIZE													
Lehmann 1984	-	-	-	-	12.9			4	33	317	s Texas 1942-52	prairie, brushland	
Lehmann 1984	-	-	1	SP	14.8			7	24	48	s Texas 1943	prairie, brushland	(1) May 11-22; (2) June 12 - July 6; (3) August 10-25. King Ranch site.
	-	-	2	SU	11.4			8	18	47			
	-	-	3	FA	10.5					40			
Roseberry et al. 1979	-	-	-	-	13.3			12.6	14.4		s Illinois 1965-68	agricultural	Minimum and maximum are yearly means.
Roseberry & Klimstra 1984	-	-	-	-	13.73	3.28 SD		6	28	347	s Illinois 1953-66	agricultural	Carbondale research area.
Simpson 1976	-	-	-	-	25.0		March			2	sw Georgia 1968-71	pine woods, farms	Month in units column is the month when the first egg of the clutch was laid.
	-	-	-	-	16.0		April			22			
	-	-	-	-	13.9		May			51			
	-	-	-	-	11.6		June			80			
	-	-	-	-	10.2		July			97			
	-	-	-	-	9.4		August			44			
Stoddard 1931	-	-	-	-	14.4			7	28	394	GA, FL 1924-29	farm, woods, thicket	

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
CLUTCHES/YEAR													
CKWRI 1991	-	-	-	-	1		/year	0	3		NS	NS	Notes that double broods in wild birds have been documented in Iowa, Texas, and Georgia, and that one female in Iowa had three broods.
Stanford 1972b	-	-	-	-	1		/year	0	2		Missouri 1950-71	NS	May replace clutches if lost before hatching; may also produce second broods.
DAYS INCUBATION													
Bent 1932	-	-	-	-	23-24		days				NS	NS	
Lehmann 1984	-	-	-	-	23		days	21	25		s Texas 1942-52	prairies, brushland	
Rosene 1969	-	-	-	-	23		days				SC, AL 1947-58	NS	
N HATCH/SUCCESSFUL NEST													
Simpson 1976	-	-	-	-	20.0		N/suc nest	MARCH		2	sw Georgia 1968-71	pine woods, farms	Number hatching per successful nest (success defined as hatching at least one egg). Month in "min" column is the month when the first egg of the clutch was laid.
	-	-	-	-	13.4		N/suc nest	APRIL		5			
	-	-	-	-	12.4		N/suc nest	MAY		23			
	-	-	-	-	9.8		N/suc nest	JUNE		58			
	-	-	-	-	9.3		N/suc nest	JULY		85			
	-	-	-	-	8.4		N/suc nest	AUGUST		33			
N FLEDGE/SUCCESSFUL NEST													
Lehmann 1984	-	-	-	-	12.2		N/suc nest			217	s Texas 1942-52	semi-prairie, brush	Successful nest defined as nest hatching young; data from eight breeding seasons.
PERCENT NESTS SUCCESSFUL													
Lehmann (unpubl.)	-	-	-	-	40		% nest suc			40	e Texas	coastal prairies	Percent of nests hatching young. As cited in Lehmann 1984.
Lehmann 1984	-	-	-	-	45		% nest suc			532	s Texas 1936-52	Rio Grande Plains	Percent of nests hatching young.
Roseberry & Klimstra 1984	-	-	-	-	32.6	8.1 SD	% nest suc	21.0	52.8	793	s Illinois 1952-66	agricultural	Percent hatching young; minimum and maximum are yearly means out of 13 years of data. Carbondale study area.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Roseberry et al. 1979	-	-	-	-	50.5		% nest suc	42.9	66.6		s Illinois 1965-68	agricultural	Percent of nests hatching young. Minimum and maximum are yearly means from four years of data. Carbondale study area.
Simpson 1976	-	-	1	-	17.5		% nest suc	15.4	19.0	412	sw Georgia 1968-71	pine woods, farms	Percent of nests hatching young. Study area: (1) Nilo; (2) Silver Lake. Minimum and maximum are yearly means.
	-	-	2	-	20.8		% nest suc	17.8	25.0	313			
Stoddard 1931	-	-	-	-	36		% nest suc	28	41	602	FL, GA 1924-27	farm, woods, thicket	Percent of nests hatching at least one egg; minimum and maximum are yearly means.
AGE AT SEXUAL MATURITY													
Johnsgard 1988	-	B	-	-	8-9		months				NS	NS (wild)	Notes that captive birds can be stimulated into reproductive activity by increased photoperiods at about 5 months of age.
Jones & Hughes 1978	-	B	-	-	16		weeks				South Carolina	lab	
ANNUAL MORTALITY													
Brownie et al. 1985	A	M	-	-	78.8	2.47 SE	%/yr	64.7	94.8	3,150	Florida	open woods	
	A	F	-	-	85.3	2.72 SE	%/yr	68.4	98.6	3,150			
	J	M	-	-	81.8	2.46 SE	%/yr	73.0	93.7	1,050			
	J	F	-	-	87.2	1.68 SE	%/yr	67.9	95.8	1,050			
Lay 1954	-	-	-	-	80						Texas	NS	As cited in Lehmann 1984.
Lehmann 1984	B	B	-	-	70		%/yr	38	87		s Texas 1940-76	semi-prairie, brush	Based on age ratio in autumn of non-hunted population. Includes juveniles surviving until fall and older birds.
	B	B	-	-	56		% Feb-Oct						
	B	B	-	-	26		% Oct-Feb						
Marsden & Baskett 1958	-	B	-	-	82		%/yr			1,546	c Missouri 1950-57	NS	Based on age ratio data from capture-recapture study of non-hunted population. Habitat described as "submarginal" with adequate cover but possibly limited winter food.
Pollock et al. 1989	B	M	-	-	81.3	1.2 SE	%/yr	70.4	90.1		Florida 1970-85	pine woods	Mortality including hunting losses; based on band recovery data.
	B	F	-	-	85.7	1.2 SE	%/yr	74.7	93.7				

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Pollock et al. 1989	B	M	-	-	52		%/yr				Florida 1970-85	pine woods	Natural mortality rate (excluding hunting losses); estimated based on above value and hunting losses. Authors suggest the experimental hunting had additive effect to natural mortality - possibly because harvest was in February, which is later than traditional hunting.
	B	F	-	-	56		%/yr						
Reid & Goodrum 1960	-	-	-	-			%/yr	60	83		sw Louisiana	NS	As cited in Lehmann 1984.
Roseberry et al. 1979	A	B	-	SU	59	12 SD	%/summer	53	80	5 yrs	s Illinois 1965-72	agricultural	Unhunted population; SIU farms site.
	B	B	-	WI	50		%/Nov-Mar	23	66	8 yrs			
Roseberry & Klimstra 1984	B	B	-	-	81		%/yr				s Illinois 1954-70	agricultural	Hunted population. Yearly value estimated from November to November. Abbreviations in units column: FA = fall; SP = spring. Juvenile rate is from hatching to 16 weeks old.
	B	B	-	-	70		%/FA-SP						
	B	B	-	-	37		%/SP-FA						
	J	B	-	-	25-47		%/0-16 wks						
Rosene 1969	A	B	-	-	71.7	5.7 SD	%/yr	48.7	75.7		AL, SC 1947-58	farms, forest	Spring to spring mortality. Average of mean values from hunted populations on four plantations. Years of study at each plantation ranged from 3 to 9. Populations from 4 plantations.
Simpson 1976	J	M	-	-	68		%/yr				sw Georgia 1967-71	pine woods, farms	Annual survival based on capture-recapture data from Oct. 15 to Oct. 15. Juvenile survival is from first to second fall.
	J	F	-	-	74		%/yr						
	A	M	-	-	54		%/yr						
	A	F	-	-	85		%/yr						
Stempel 1960	-	-	-	-	80-90		%/yr				s Iowa	NS	As cited in Lehmann 1984.
LONGEVITY													
Lehmann 1984	-	-	-	-	10.6		months			484	Texas 1942	semi-prairie, brush	Expected remaining longevity for quail surviving from hatching to November.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Marsden & Baskett 1958	-	B	-	-	8.5		months			1,546	c Missouri 1950-57	NS	Expected remaining longevity for quail surviving from hatching to October. Based on age ratio data from capture-recapture study of non-hunted population. Habitat described as "submarginal" with adequate cover but possibly limited winter food.
Marsden & Baskett 1958	-	-	-	-			years			5	c Missouri 1950-57	NS	Greatest longevity found in capture-recapture study.
Rosene 1969	-	-	-	-	9.1-11.7		months				AL, SC 1947-58	farms, forest	Range of mean longevity estimates for hunted populations. Values apply to individuals surviving from hatching to November from four plantations.
Smith et al. 1982	-	-	-	-			years			5	Florida 1970-79	pine woodlands	Greatest longevity found in study.

***** SEASONAL ACTIVITIES *****

Reference	Begin	Peak	End	Location	Habitat	Notes
MATING/LAYING						
Bent 1932	Mar	May - Jun	Aug	Florida	NS	
Guthery et al. 1988	mid Mar	Apr-Aug	late Aug	s Texas 1981-83	plains	
Lehmann 1984	mid Apr		mid Aug	s Texas 1941-52	prairie, brushland	
Roseberry & Klimstra 1984	Apr	mid May-Jul	Sep	s Illinois 1953-80	agricultural	
Simpson 1976	late Mar	May - Jul	late Aug	sw Georgia 1968-71	pine woods, farms	
HATCHING						
Case & Robel 1974		Jun-earl Jul		Kansas	NS	
Lehmann 1984	mid Mar	May - Jun	mid Sep	s Texas 1946-64	prairie, brushland	

Reference	Begin	Peak	End	Location	Habitat	Notes
Roseberry & Klimstra 1984	mid May	Jun - Aug	earl Oct	s Illinois 1953-80	agricultural	
Rosene 1969	May	Jul-Aug	late Sep	S Carolina, Alabama	farm, woods	
Sermons & Speake 1987		Jul	Sep	Alabama 1984-85	NS	
Simpson 1976	late May	Jul - Aug	earl Oct	sw Georgia 1968-71	pine woods, farms	
Stanford 1972a	earl May	mid June	Oct	Missouri 1948-71	NS	A second smaller peak occurs in mid August.
Stoddard 1931	late Apr	May-Aug	Oct	sw GA, n FL 1924-29	farm, thicket, woods	
FALL/BASIC MOLT						
Bent 1932	Aug	Sep	Oct	NS	NS	Adults undergo a complete molt.
Bent 1932	Aug		Nov	NS	NS	First fall molt (juveniles); timing depends on when bird hatched.
Stanford 1972a	May	June-Sept	Oct	Missouri 1948-71	NS	Onset of molt in adult females; most delay wing molt until after young hatch.
Stoddard 1931	Aug-Sep		Oct-Nov	sw GA, n FL 1924-29	farm, thicket, woods	Complete molt.
SPRING/ALTERNATE MOLT						
Stoddard 1931	earl Feb	Mar-Apr	earl Jun	sw GA, n FL 1924-29	farm, thicket, woods	Renewal of feathers on throat, sides of head, and forehead.